TR-29

TECHNICAL REPORT

OPERATION DEEP FREEZE II
1956-1957
OCEANOGRAPHIC SURVEY RESULTS

Oceanographic Survey Branch
Division of Oceanography

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ABSTRACT

Results of oceanographic operations during the U.S. Navy Antarctic Survey Operations in support of DEEP FREEZE II, 1956-1957 are presented.

In the Little America Area the surface layer temperatures varied greatly, depending on currents, winds, and shelf-ice melting. A temperature minimum was likely at about the 200-meter depth close to the Ross Ice Shelf. Low salinities (34.00 ‰ or less) were evident in the surface layers near the ice shelf.

In the McMurdo Sound Area water mass characteristics were nearly identical for any given time; changes were brought about by seasonal variation.

The Antarctic Convergence is not well delineated. Vertical temperature and salinity measurements taken north of, in, and south of the convergence in the Atlantic, Pacific, and Indian Oceans depict the water dissimilarities; surface positions are shown.

The Antarctic bottom sediments coincide closely with the continental shelf. They are of marine glacial type, for the most part unsorted, and primarily of terrigenous origin. The dominant mineral of the sediments appears to be feldspar, while quartz and a wide variety of rock fragments are of secondary importance. Organic remains include Foraminifera, Radiolaria, sponge spicules and many other forms. These sediments generally range in color from olive grey to yellowish brown, possess low to medium sphericity, and vary in degree of roundness from subrounded to angular. Sediments are predominantly volcanic, in the McMurdo Sound-Cape Adare region, primarily rock fragments in the Weddell Sea, and primarily organic in the Wilkes coast region.

Occurrence and depth of the deep scattering layer (DSL) were observed and reported throughout the cruise.

Ice observations and reconnaissance by the USS GLACIER, USS ATKA, USS STATEN ISLAND, and USCGC NORTHWIND are presented and discussed.

FOREWORD

DEEP FREEZE II was the third consecutive U. S. Navy Antarctic Expedition in support of the International Geophysical Year. Personnel from the U. S. Navy Hydrographic Office, aboard four icebreakers, collected oceanographic and hydrographic data whenever the primary objectives of the operation permitted. The analysis of these data are presented in this report.

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Rear Admiral, U. S. Navy
Hydrographer

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I. INTRODUCTION

A. Purpose

Operation DEEP FREEZE II (1956-1957), the third consecutive U. S. Navy expedition to penetrate the Antarctic within as many years, transported scientific personnel and equipment to man bases of the U. S. National Committee for the International Geophysical Year. In addition, several secondary bases were established; ELLSWORTH STATION on the Filchner Shelf, WILKES STATION on the Budd Coast, ADARE STATION on Cape Hallett, BYRD STATION in Marie Byrd Land, and the AMUNDSEN-SCOTT STATION at the South Pole. Many of the secondary scientific projects initiated during the 1954-1955 and DEEP FREEZE I expeditions were continued. Personnel from the U. S. Navy Hydrographic Office collected oceanographic and hydrographic information whenever the primary objectives of the operation permitted.

B. Summary of Operations

The oceanographic and hydrographic data collection programs undertaken during DEEP FREEZE II operations were conducted aboard four icebreakers, USS GLACIER (AGB-4), USS STATEN ISLAND (AGB-5), USS ATKA (AGB-3), and USCGC NORTHWIND (WAGB-282)(Fig. 1). This program included oceanographic stations using reversing thermometers and Nansen bottles, bathythermograph observations (BT's), meteorological observations, ice observations, bottom sampling, transparency and water color readings, continuous temperature recordings, biological collections, and oceanic soundings.

A total of 50 oceanographic stations was obtained; 26 in the Weddell Sea area, 14 in the Ross Sea area, 4 off Wilkes Coast Land, 5 off the west coast of South America, and 1 near New Zealand. Dissolved oxygen analyses were scheduled for all ships and all water samples. Unfortunately, pollution of one of the reagents caused drifting and excessively high standardization runs, and thus, the absolute values are erroneous to varying degrees. Nevertheless, the data are of some value in that results are valid from a relative viewpoint and show depths of maximum and minimum values. All of these data are tabulated in Annex A.

Bathythermograph lowerings, with the 900-foot instrument, were scheduled on an hourly basis on the four icebreakers, and on a once-a-watch (four-hour) basis on certain ships of the Task Force, the ARNEB, WYANDOT, and BROUGH. Equipment failure, weather conditions, shortage of personnel, and presence of ice all tended to reduce the number of lowerings accomplished, but in areas of particular interest, such as the Antarctic Convergence Zone, the rate of lowerings was increased. The total number of bathythermograph records obtained aboard the icebreakers was 1595 slides by the GLACIER, 721 by the

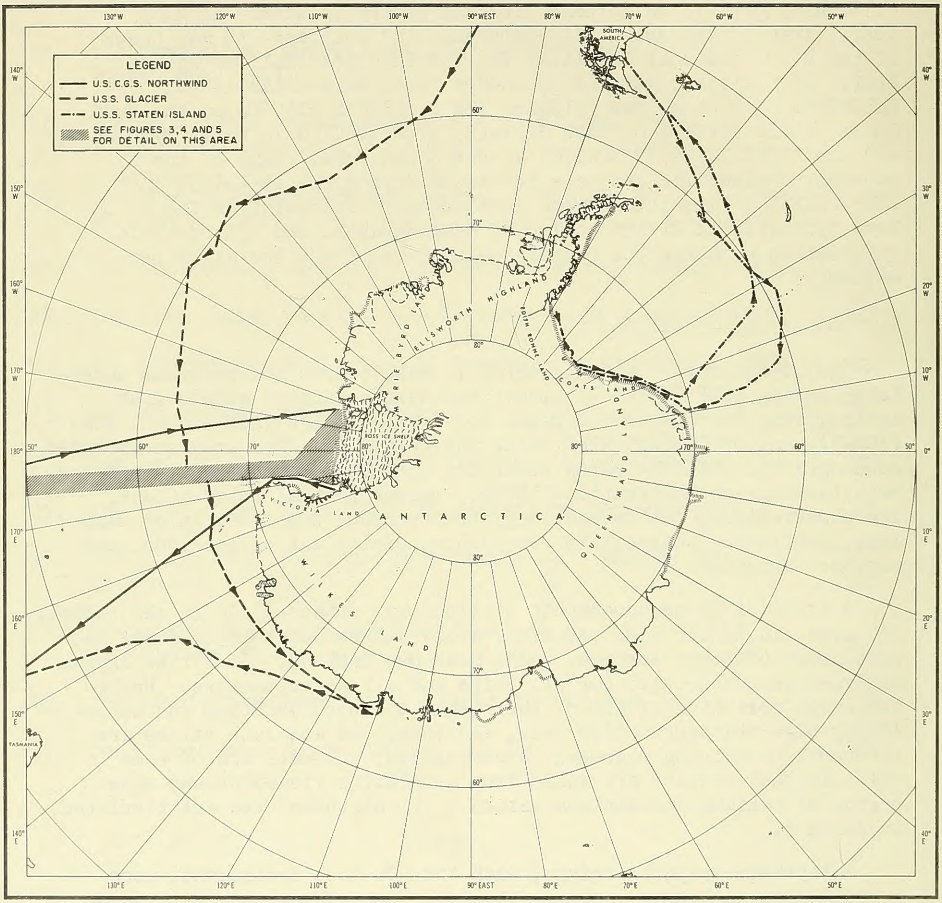

Fig. 1. Tracks of icebreakers conducting oceanographic work on DEEP FREEZE II.

STATEN ISLAND, 1057 by the ATKA, and 984 by the NORTHWIND. The ARNEB obtained 290 records, the WYANDOT 155, and the BROUGH 154. These bathythermograph records with associated meteorological data are processed by the U. S. Navy Hydrographic Office, retained on file, and copies distributed to interested activities.

Meteorological observations were made and recorded hourly by enlisted aerographers assigned to each icebreaker. These data are on file at the National Weather Records Center, Ashville, North Carolina. In addition, selected meteorological data are recorded as an integral part of the oceanographic station record and each bathythermograph observation. These data include, in addition to the standard meteorological data, sea surface temperature and sea and swell data.

Direct ice observations were made aboard all icebreakers, recording thickness, age, and type. These observations were made by either quartermasters at hourly intervals, or by aerographers at 3-hour intervals. Observations were controlled and supplemented by the oceanographers aboard. Photographs of ice conditions and other aspects of oceanographic operations in the Antarctic are presented in Annex C.

Bottom sampling was undertaken in all areas of interest whenever possible. A total of 43 samples was obtained during this operation; 40 from the Antarctic Continental Shelf, one on the continental slope in the Weddell Sea, and two in the New Zealand area. The analyses of these data are listed in Annex B.

Transparency and color estimates were made during oceanographic stations, and under daylight conditions. The transparency of the sea water was estimated through the use of a white (Secchi) disc, 30 cm. in diameter. This disc was lowered into the water until it disappeared from sight. The depth of the point of disappearance was then measured in meters and recorded. On the STATEN ISLAND and ATKA, a black 30 cm. disc was also used; however, these data do not appear in the data listings (Annex A), but can be found in the original data on file in the Hydrographic Office. Transparency estimates using the Secchi disc are influenced by the available light, the visual acuity of the observer, and wind disturbances on the water surface. Thus the observations should be considered general in nature, and of predominate interest for their gross relative value. Water color estimates were made visually by comparison between the sea water color and a Forel color scale. As this scale only covers the blue-green-yellow color range, its use is limited. In addition, the color perception of the observer, the depth of water, the light available, the amount of cloud cover, and wind disturbances on the water surface are other factors decreasing the accuracy of the observations. However, despite these limitations, color observations have some relative value.

Continuous temperature records of both sea surface and air were obtained aboard three of the icebreakers. The GLACIER, NORTHWIND, and STATEN ISLAND were equipped with balanced, recording potentiometers, each connected with several thermistors. One thermistor was held

below the surface of the water by an over-the-side pipe (GLACIER and NORTHWIND) or by trailing in the surface water (STATEN ISLAND). Other thermistors were installed at the main deck level, or lower, in order to obtain a continuous air temperature record at low levels.

On the GLACIER, air elements were located at welldeck level (approximately 18 feet above the water surface), and also at a position outboard of the ships' side and about five feet above the water surface. The sea element was mounted in a fixed pipe attached to the hull. The NORTHWIND installation included a mounting unit holding the sea element which permitted free swing fore and aft. The air element was mounted on a wooden beam under the flight deck (15 feet above the water surface). The STATEN ISLAND trailed its sea element just aft of the starboard screw and the air element was installed on the wooden beam of the overhead in the amidships' passageway (15 feet above the water surface). All continuous temperature records are on file at the U. S. Navy Hydrographic Office.

In cooperation with the Office of Naval Research, the U. S. Fish and Wildlife Service, and the U. S. National Museum of the Smithsonian Institution, oceanographers participating on DEEP FREEZE II collected biological material and observations whenever possible. The intention was to provide a representative collection of surface, midwater, and benthonic marine forms found in the Antarctic area. The majority of bottom specimens was secured from the shelf areas of the Weddell Sea, Ross Sea, and off the Wilkes Coast.

Equipment used included a three-foot Blake trawl, a 14-inch triangular dredge, an orange-peel bottom sampler, collapsible fish traps, ring traps, and an experimental Alaskan shrimp trap. One-half-meter plankton nets of various mesh sizes were employed in vertical and horizontal hauls. Six-inch Birge closing nets of No. 5 and No. 12 mesh were also employed in vertical serial hauls.

All biological material collected has been forwarded to the Smithsonian Institution for sorting and storage. Distribution of specimens to specialists and interested agencies will be coordinated by that institution. Results of biological findings will be published as a collective unit by the U. S. National Museum. Micro-organisms present in frozen bottom sediment samples from the Weddell Sea area will be reported on by the Scripps Institution of Oceanography, La Jolla, California.

No formal program for hydrography or cartography was specified for Operation DEEP FREEZE II other than that which could be accomplished on a routine basis by the ships' personnel. Aboard icebreakers, the oceanographer was often able to assist or advise in certain phases of this limited program. Continuous oceanic soundings using echo

sounders were taken by all four icebreakers and the WYANDOT, ARNEB, CURTIS, and NESPELEN. In some cases, such as aboard the STATEN ISLAND, the echo sounder was malfunctional beyond the repair capacity of the ship's force, and the data returned were limited in amount and quality.

All soundings obtained are processed and retained in the U. S. Navy Hydrograpnic Office, and are being incorporated in revised editions of pertinent charts, or in new charts published by this Office. Reports on dangers and aids to navigation, displacements of major coastal features, chart correction information, and position and contours of the shelf ice edge are also processed and retained within this Office, for incorporating into existing or new publications.

A limited small boat survey of the water areas surrounding Wilkes Station in the Windmill Islands off the Budd Coast was undertaken. On the return voyage back to the United States, the GLACIER undertook a brief and unsuccessful search for Maria Theresa Reef, originally reported in November, 1843, at about 151°13'W between 35° and 37°S.

C. Participating Personnel

The following four oceanographers from the U. S. Navy Hydrographic Office participated aboard icebreakers in Operation DEEP FREEZE II:

USS GLACIER - - - - - Dr. Willis L. Tressler, Senior Hydrographic Representative
USS STATEN ISLAND - - William H. Littlewood
USCGC NORTHWIND - - - James Q. Tierney
USS ATKA - - - - - - Robert B. Starr

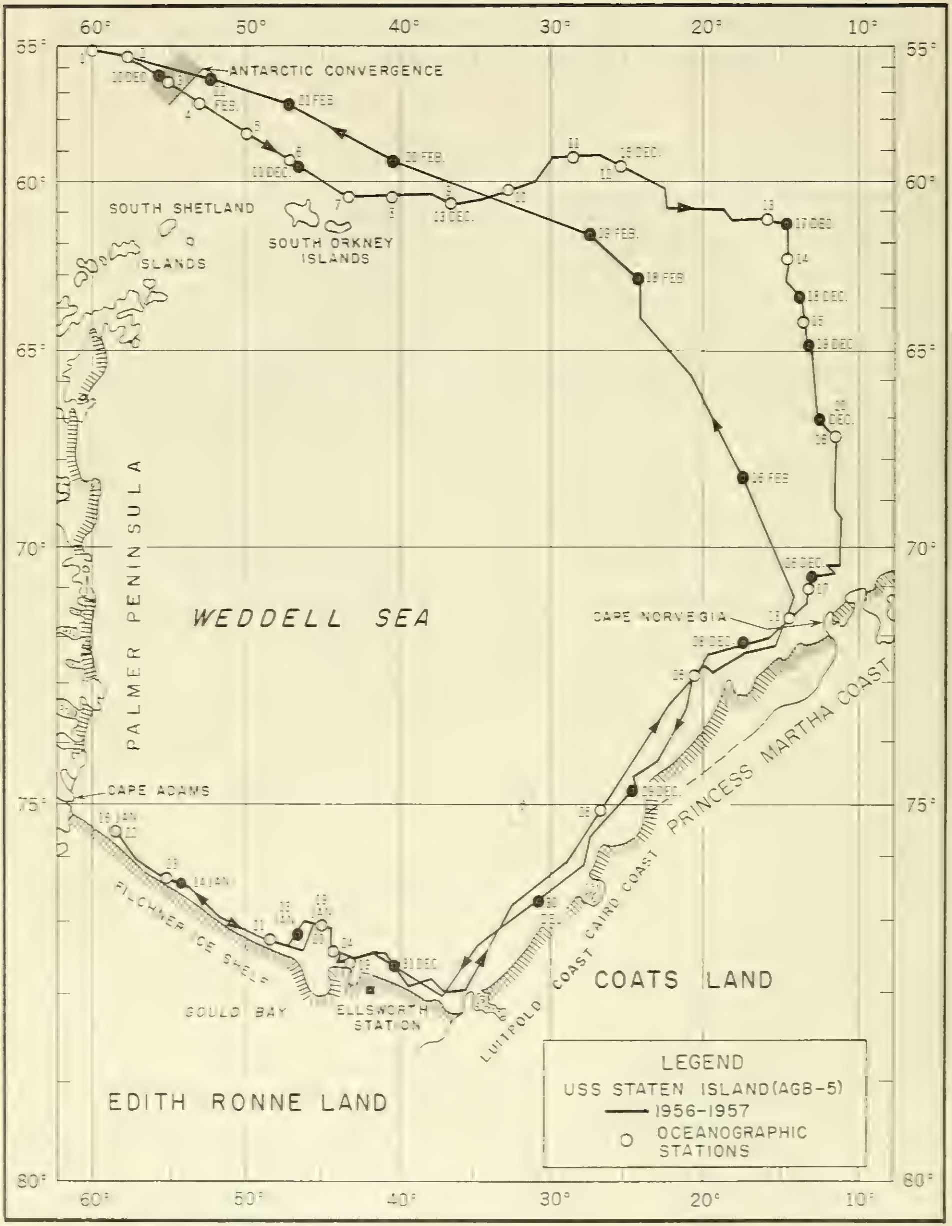

Fig. 2. Track and station location chart, USS STATEN ISLAND - DEEP FREEZE II.

II. WEDDELL SEA AREA, OCEANOGRAPHY

A. General

The perimeter of the Antarctic Continent is indented by two great seas, the Ross and Weddell. The Weddell Sea lies south of the western South Atlantic, and differs principally from the Ross Sea in two ways; (1) it has areas of great depths, and (2) it is bounded on the west by the most northerly extension of Antarctic Land, the Palmer Peninsula.

The southerly end of the Weddell Sea is covered with a great ice shelf (Filchner Ice Shelf), and the actual shoreline beneath this ice is unknown at present. Various glaciers and ice shelves also extend along the eastern and western sides of the sea, so that the percentage of exposed or nearly exposed land at sea level is at a minimum.

The sea itself is generally ice filled, even in summer months, and the current pattern (clockwise, with water entering at the northeast) plus the prevailing winds seem to pack the ice along the western side. This wind and current action makes ship entry possible along the eastern side, although changes in local winds may close leads temporarily. Until Operation DEEP FREEZE II, no ship had ever penetrated to the southwest corner of the sea. However, the USS STATEN ISLAND, followed by the cargo ship USS WYANDOT, was able to penetrate to within about forty miles of the southwest corner during the month of January. This was accomplished despite severe setbacks by increased ice pressure during periods of northerly winds.

B. Physical Properties

Twenty-six oceanographic stations were taken along the ship's track (Fig. 2). Five stations were also taken off the west coast of Chile, and although all station data are presented in Annex C, these latter stations are out of the area and will not be discussed.

1. Temperature

During the December crossing of Drake Passage, water temperature north of the Antarctic Convergence decreased gradually with depth (Fig. 3). South of the convergence, temperatures decreased with depth, except for a thin isothermal surface layer, with a minimum reached at about 200 to 400 meters. Increases were noted as the warm, deep water was encountered. Further south (Station S.I.-7) the summer warming of the surface layers was proportionately less as the edge of the ice pack was approached. Here, the minimum temperature remnant was found at about ninety meters depth, with more gradual warming below. Observations on these stations were not deep enough to encounter the cold Antarctic Bottom Water.

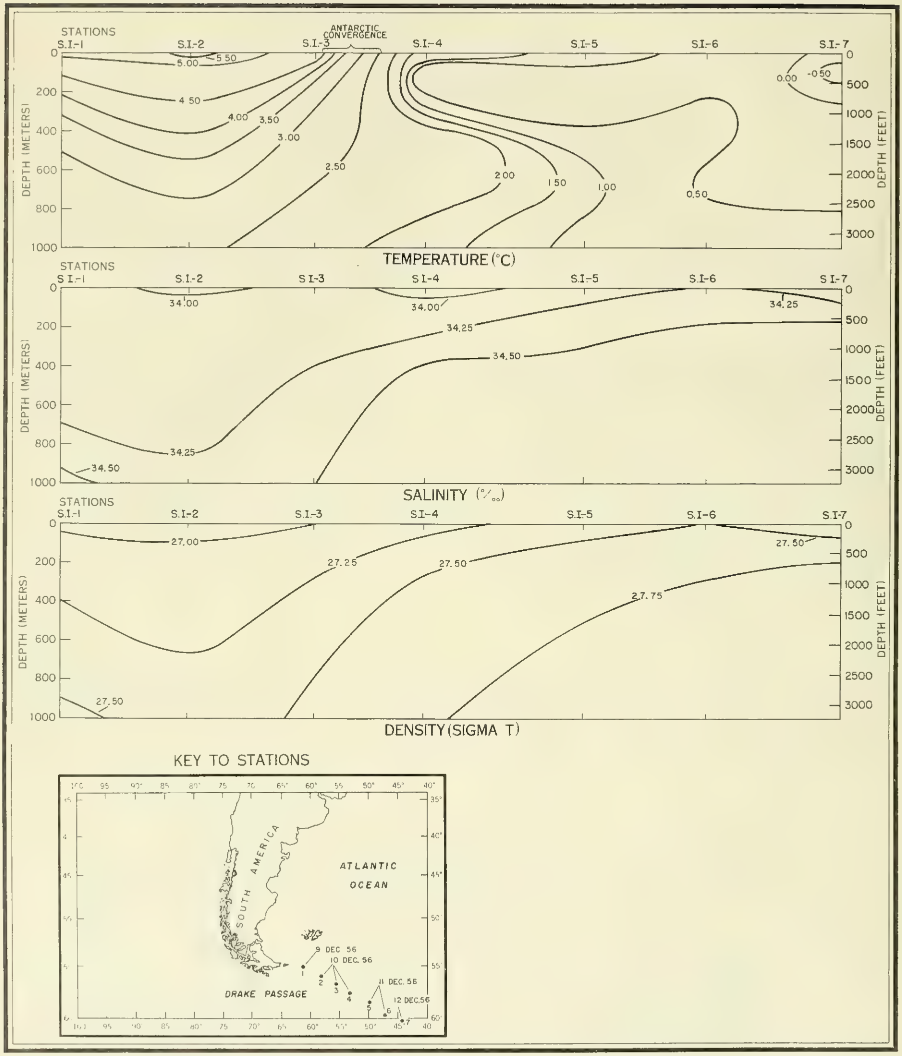

Fig. 3. Vertical distribution of temperature, salinity, and density in Drake Passage, USS STATEN ISLAND - December 1956.

Further south, surface temperatures continued to decrease particularly in areas of pack ice and icebergs. On the northern perimeter of the Weddell Sea the depth of the temperature minimum extended from the surface to 50 meters, unless the pack ice had disintegrated and the resultant heating from summer insolation had begun.

Within the pack ice itself a series of stations southward showed a temperature-maximum layer, with temperatures between 0.5°C and 1.0°C at a depth of about 300 meters (Fig. 4). This layer is apparently the remnant of the warm deep layer, now at relatively shallow depths, surrounded by colder water above, below, and to the south. This product of the warm, deep water is now termed the Antarctic Circumpolar Water.

Within the Weddell Sea, water temperatures were generally isothermal over shelf area with minimums of -2.0°C. Bathythermograph traces in the Weddell Sea itself showed this isothermal water over the shelf areas with slight surface warming when leads were large enough and stable enough to permit heating from insolation. In the deeper areas just outside of the Weddell Sea limits, the typical summer surface situation was present, with the warm, deep layer underlying the colder Antarctic Surface Water. The surface itself was warmed by summer insolation if ice was not present. No bathythermograph lowerings were possible in the deeper area within the Weddell Sea. Seasonal warming of the surface waters within the ice-filled Weddell Sea appeared to be an intermittent phenomenon, dependent upon the presence and longevity of leads and polynyas.

In summary, the temperature mechanics of the Weddell Sea area appear to be as follows: The water that is chilled along the Antarctic Shelf areas flows down over the Antarctic Continental Slope to form Antarctic Bottom Water with a northward set. It thus passes under the Antarctic Circumpolar Water and eventually under the warm, deep water. Meanwhile, the warm, deep water has a southward set, and rises at the Antarctic Convergence to shallower depths where it mixes with adjacent waters and forms the Antarctic Circumpolar Water. The upper layers of the Antarctic Circumpolar Water are chilled by the cold Antarctic winters, and are mixed-out and diluted with great quantities of melt water and precipitation. The water mass is then called the Antarctic Surface Water. Summer heating may slightly rewarm the surface after melting or moving ice exposes the water to insolation, and a temperature-minimum layer is thus isolated just above the Antarctic Circumpolar Water. In winter the surface is again cooled and vertical mixing takes place, producing isothermal cold water overlying the Circumpolar Water.

The temperature structure for a typical summer station over the Weddell Shelf is illustrated by Station S.I.-24. Extensive pack ice prevented extensive surface warming. This is an extremely simplified and generalized explanation, and refers only to north-south components in the water movement. It should be remembered that the major surface currents are circumpolar, following the great wind belts. Discontinuity in the bottom topography and fluctuating meteorological conditions will create local variations that may be temporarily adverse to the above explanation. More data are required before the situation

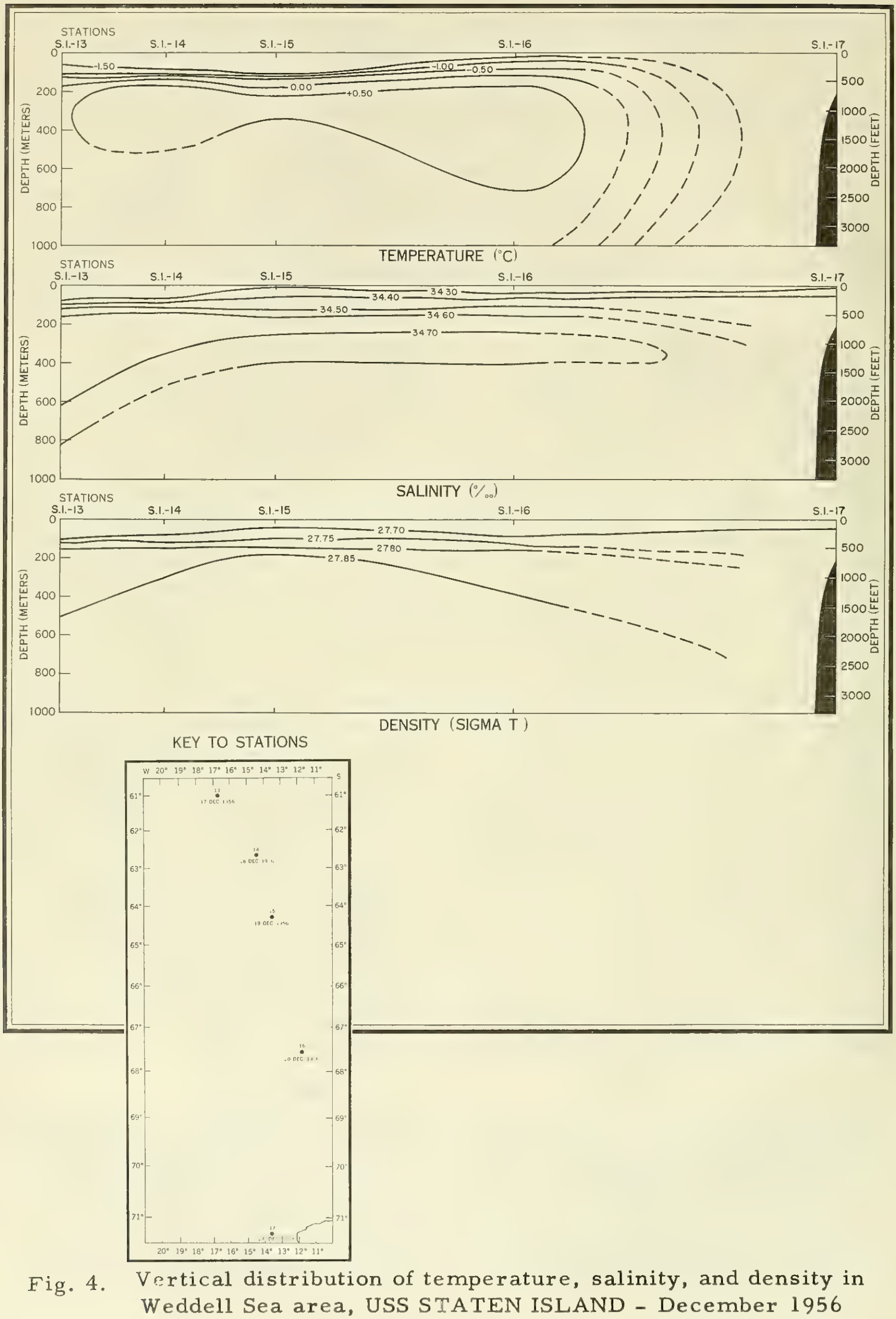

Fig. 4. Vertical distribution of temperature, salinity, and density in Weddell Sea area, USS STATEN ISLAND - December 1956

and explanation is definitely known.

2. Salinity

The salinity values derived from water samples collected in the Weddell Sea area were generally typical for the Antarctic Regions. Figure 3 illustrates the salinity structure obtained from a series of oceanographic stations across Drake Passage. Surface salinities were variable, averaging about 34.00 $^{o}/oo$ (between 33.89 $^{o}/oo$ and 34.26 $^{o}/oo$). Salinities increased with depth, but the gradient was much shallower and somewhat sharper south of the Antarctic Convergence than north of it because the warm, deep water that rises in the region of the convergence also contained a greater salinity than the surrounding waters. The salinity maximum that originated in the warm, deep water is maintained in the Antarctic Circumpolar Water and is generally 34.70 $^{o}/oo$ or higher (Fig. 4). However, the salinity gradient below this maximum is very gradual and this zone of transition and vertical mixing makes it difficult to determine where the Antarctic Bottom Water is definitely encountered.

Surface salinity values within the Weddell Sea itself are generally higher than to the north. However, many exceptions to this statement are found as melting glacial, shelf, or old pack ice decreases the surface salinity and the freezing sea water releases salt, increasing the salinity. Local conditions of precipitation versus evaporation also contribute to surface salinity fluctuations.

The salinity structure for a typical summer station over the Weddell Shelf is illustrated by Station S.I.-24. Extensive pack ice prevented extensive surface diluting through melting.

3. Density

Figure 3 is a profile of density values across Drake Passage. Densities generally increased southward and with depth. The density increase southward results from the climatic decrease in temperatures southward. The density increase with depth predominantly results from a temperature decrease north of the Antarctic Convergence, and from a salinity increase south of the convergence.

Near the pack ice areas of the Weddell Sea, and within the sea itself, the surface densities varied with the surface temperature fluctuations, and the corresponding melting or freezing conditions of the pack of glacial ice. Melting conditions quickly lower and stabilize surface densities, both from higher temperatures and from the release of fresh water to the surface layers. Conversely, freezing conditions lower temperatures and separate salt ions from the sea water, thus causing an increase in density. This often creates a temporary unstable condition, with denser water at the surface; however, vertical mixing soon stabilizes the situation, deepening the isopycnal layer. In the

case of extended cold periods so prevalent over shelf areas in the southern end of the Weddell Sea, this isopycnal condition will extend to the bottom. Thus, the combination of much salt from the freezing process and the freezing-point temperatures probably creates water dense enough to flow over the shelf and form Antarctic Bottom Water. The majority of all Antarctic Bottom Water is believed to be formed in the Weddell Sea. The density structure for a typical summer station over the Weddell shelf is illustrated in Station S.I.-24.

Figure 4 illustrates the density profile from a group of stations just outside of the Weddell Sea. As these stations are taken in open areas (polynyas) within the ice pack, they may imply greater stratification of the physical factors than actually exist. The stratification is very likely to be much weaker between these pools of exposed water. In any case, the density gradients with depth are extremely weak and the presentation of this particular figure has been based upon sigma-t differences of only 0.15 to illustrate the structure.

III. ROSS SEA AREA, OCEANOGRAPHY

A. General

The Ross Sea lies south of the Pacific Ocean between 160°E and 150°W. It is a large open body of water with depths generally less than 400 fathoms and with free circulation to the circumpolar ocean waters to the north.

To the south, the sea is bounded by the floating seaward margin of the Ross Ice Shelf. Many glaciers and small ice shelves extend along its margins, but in spite of this, a relatively large percentage of land is exposed during the summer season. Sea ice forms during the autumn and winter seasons, but usually breaks up sufficiently in late summer to permit ship transit to all corners of the sea. A general east to west set removes much of the ice and bergs, but some are confined in a gyral in the northern portions of the sea.

B. Physical Properties

Fifteen oceanographic stations were taken across the convergence and in the Ross Sea (Figs. 5, 6, and 7). Of these, GLACIER stations 3 through 6 (Fig. 5) taken in November, provide the only usable section for oceanographic description. The stations taken in McMurdo Sound and Kainan Bay are similar to those discussed in the DEEP FREEZE I report.*

1. Temperature

The thermal structure of the Ross Sea in early November probably represents a relatively unmodified winter condition. The surface area of the section was covered with sea ice and surface temperatures held close to -1.8°C. The water in these moderately shallow depths is essentially isothermal except at the northern station (GL-6) where a warm tongue with maximum temperatures greater than 0.8°C at 200 to 250 meters intrudes (Fig. 8). This is the southern extent of the main part of the Antarctic Circumpolar Water. This water shows up again at station GL-4, with a maximum temperature of -0.4°C at 200 meters. This is either a partially mixed-out discontinuous extension of the Antarctic Circumpolar Water, or perhaps the southern arm of a subsurface gyral of this water in the Ross Sea.

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* H. O. 16331-1, U. S. Navy Hydrographic Office Report on Operation DEEP FREEZE I, Oct. 1956, U. S. Navy Hydrographic Office, Washington, D. C.

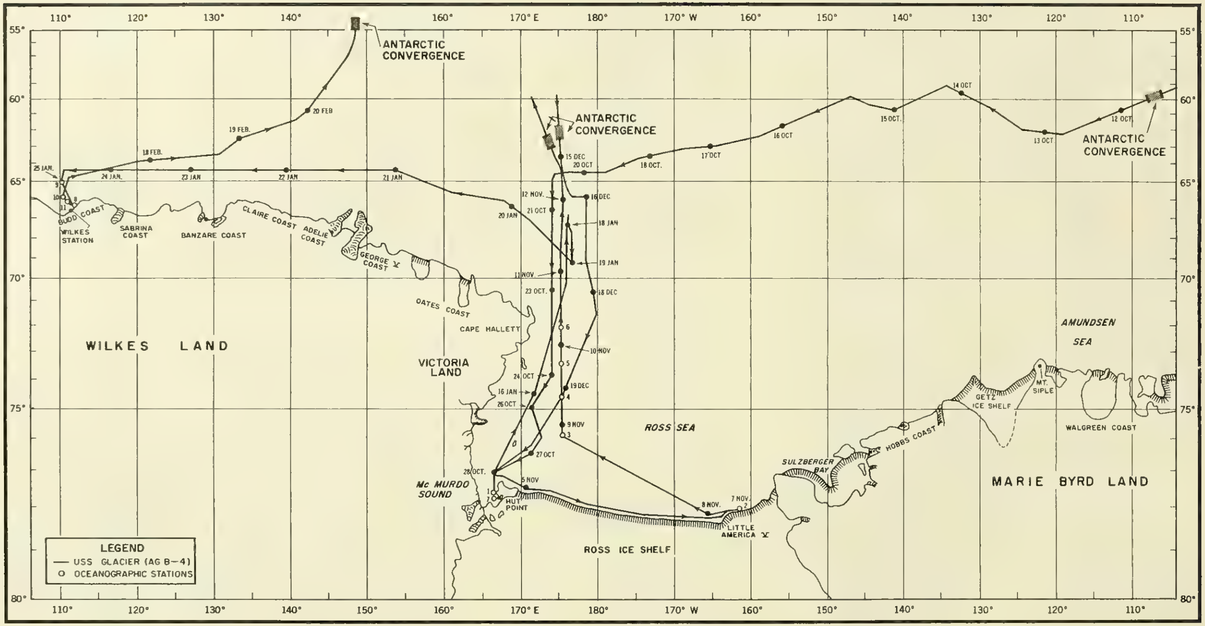


Fig. 5. Track and station location chart, USS GLACIER - DEEP FREEZE II

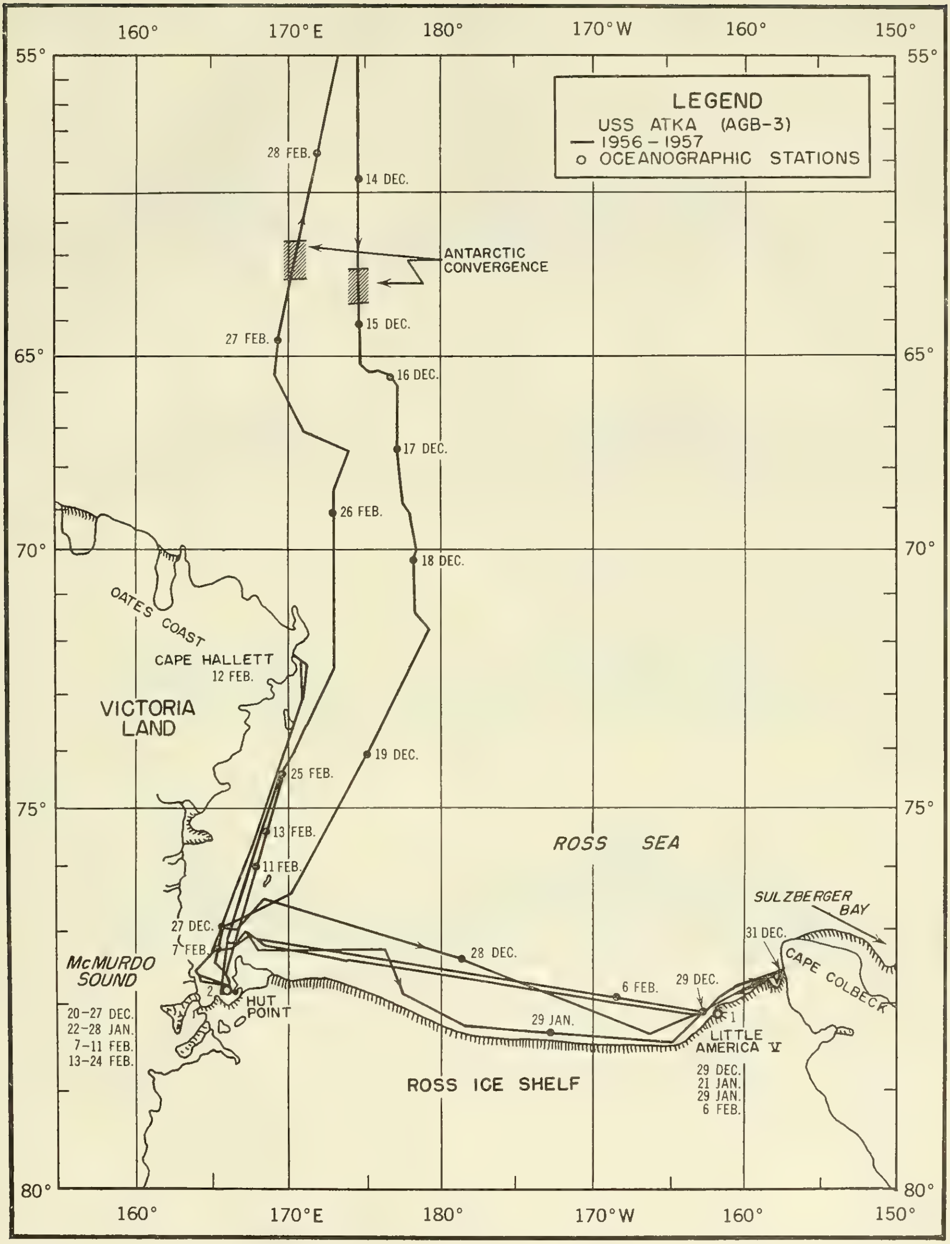


Fig. 6. Track and station location chart, USS ATKA - DEEP FREEZE II

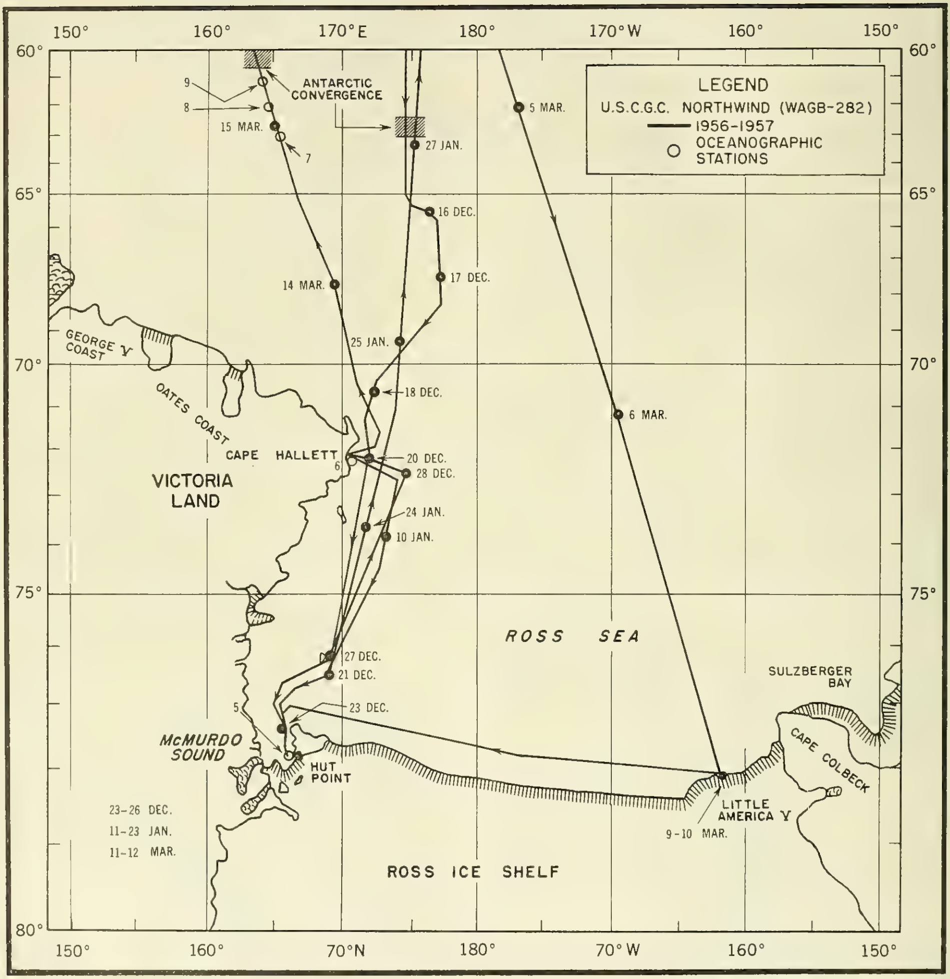


Fig. 7. Track and station location chart, USCGC NORTHWIND - DEEP FREEZE II

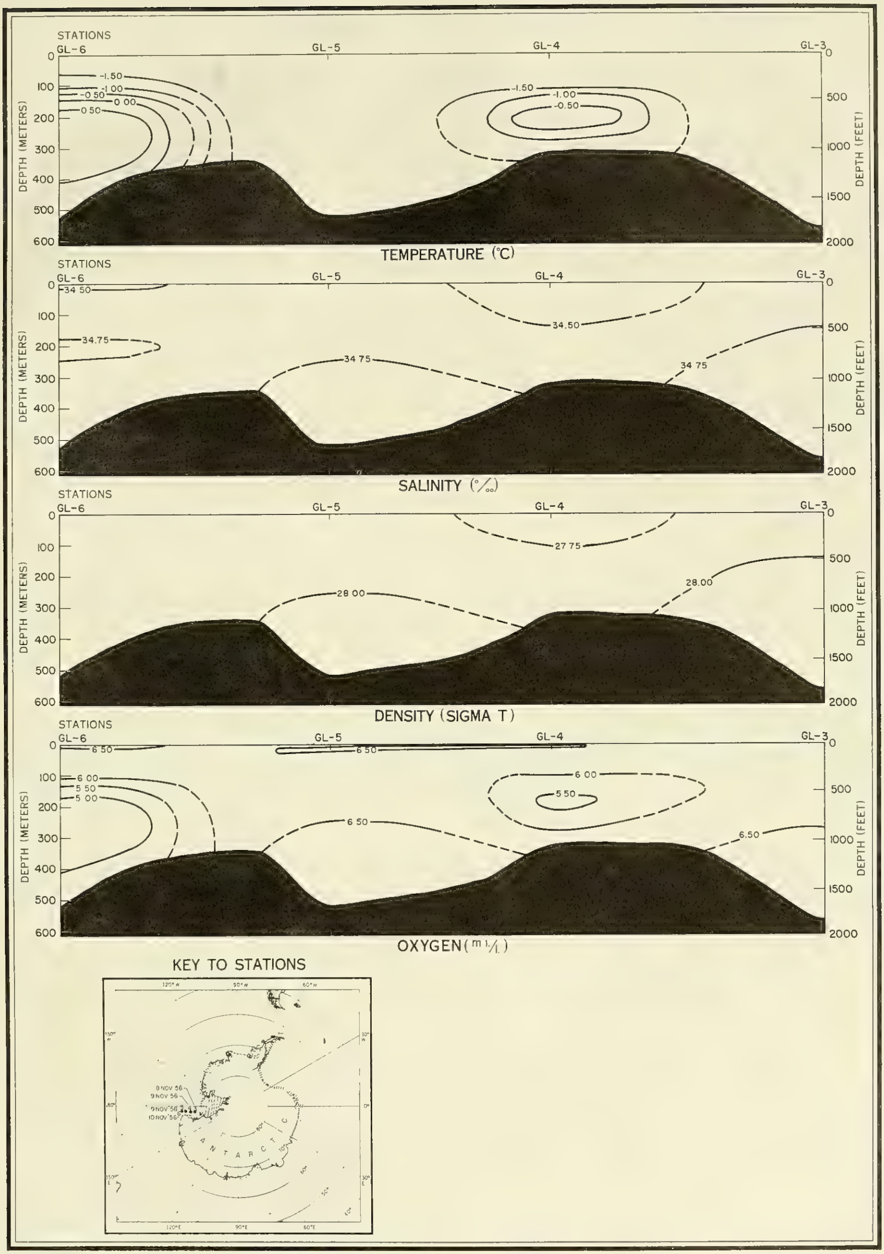


Fig. 8. Vertical distribution of temperature, salinity, density, and oxygen in Ross Sea area, USS GLACIER - November 1956

2. Salinity

Salinity values along this section through the Ross Sea show a normal, gradual increase with depth except at station GL-6 where a slight salinity maximum of 34.79 ‰ occurs at 200 meters. This is probably associated with the core of the Antarctic Circumpolar Water (Fig. 8). High bottom salinities (greater than 34.85 ‰) occur in the bottom depression at station GL-5, and also in one at Station GL-3 near the Ross Ice Shelf. These probably represent surface water wherein salinity has been increased during the winter from freezing of sea ice and consequent concentration of brine which has sunk to the bottom.

3. Density

The density structure indicated in Figure 8 appears more dependent on the salinity structure than on the minor effects of thermal differences in the cold water of the section. The relatively high bottom salinities and low temperatures account for the formation of water with a sigma-t well over 28.00. This flows north from the Ross Sea and down the continental slope, and probably contributes to the Antarctic Bottom Water.

4. Currents

Current observations were made from the USCGC NORTHWIND while moored to the fast ice at the west side of Moubray Bay inside Cape Hallett, near the mouth of the bay. An Ekman meter was used at a depth of 30 feet, with a water depth of 80 feet. Observations were made at hourly intervals for a period of 40 hours, except for brief periods when ice cover or diving operations precluded the use of over-the-side equipment; concurrent records were made of wind velocity and direction. Although the limited amount of data and the complications of ice movement limit the usability of the records, the currents, in general, were found to vary between 0 and 2.7 knots, flowing out of the bay along the eastern side. Correlation with wind and the general circulation of Moubray Bay was impossible to determine because of sparsity of data and the extensive ice cover of the bay.

IV. VINCENNES BAY, OCEANOGRAPHY

A. General

Vincennes Bay lies between the Budd and Knox coast at about 110°E. The water of Vincennes Bay is comparatively shallow as far north as about 65°S where the continental slope drops off rapidly into deep water. Most of the bay is apparently shallower than 500 fathoms, although very few sounding lines have been run to date. Vincennes Bay normally appears to be ice free during the summer season, except for some grounded bergs. During periods of northerly gales, it may contain heavy ice pack as late as early February. This was the case in late January 1957, but three weeks later the pack ice had largely disintegrated or moved northward.

The USS GLACIER was in Vincennes Bay from 25 January to 17 February 1957. During the period from 31 January to 17 February, a reconnaissance run was made north as far as about 65°S to observe ice conditions and occupy oceanographic stations.

B. Physical Properties

Station GL-8 was taken off Clark Island (Windmill Islands) in shallow water; stations GL-9, GL-10, and GL-11 were occupied one week later in a line extending south from 65°20'S along 109°E (Fig. 5).

1. Temperature

Temperatures of these four stations off Vincennes Bay were relatively cold at all depths of measurement (Fig. 9). A slight summer surface warming was most noticeable at the shallow station, GL-8, probably resulting from coastal leads permitting greater insolation of the water thus exposed.

The small temperature inversion recorded at shallow depths on stations GL-8 and GL-10 are probably due to pack ice belts recooling surface water after initial warming by insolation. When leads develop, insolation warms the surface, causing a temperature inversion at shallow depths. These inversions are often stable from a density viewpoint because of the lowering of salinity at the surface. However, if refreezing occurs, the inversion may not be stable.

An interesting illustration of this occurred during an oceanographic station occupied during March 1956 (GL-12), discussed in the DEEP FREEZE I report. This station was taken under freezing conditions, with ice crystals forming on the surface. This caused surface temperatures to drop to below -2.0°C and the inversion was considered temporary and unstable. When compared to station GL-9 (Operation DEEP FREEZE II), it is obvious that the water stabilized through vertical mixing (Fig. 10).

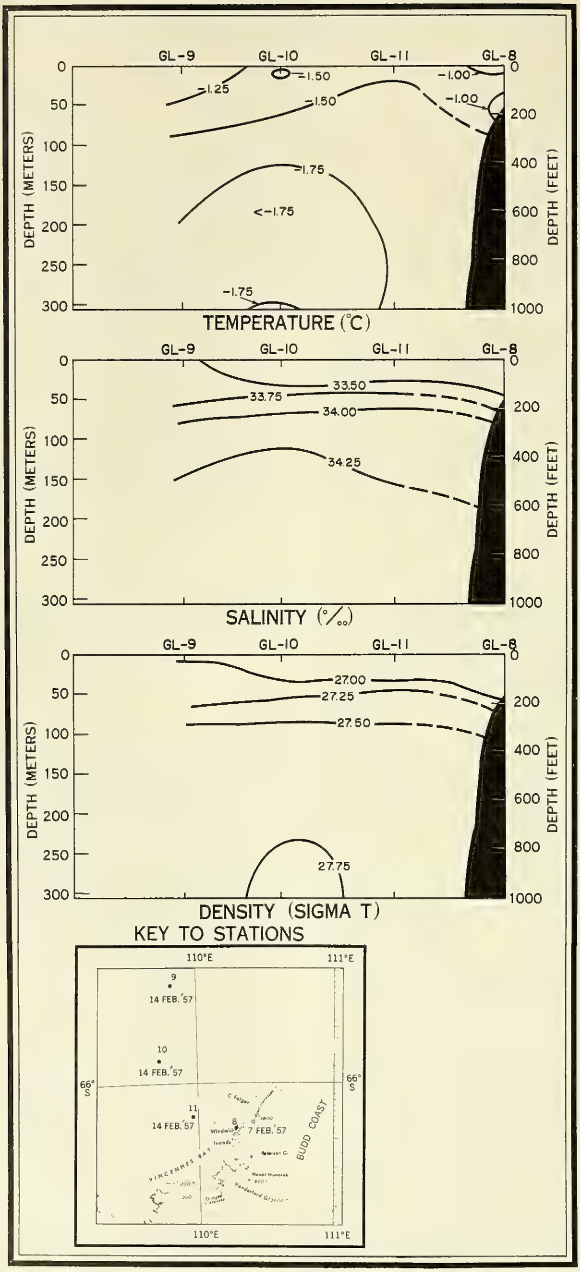
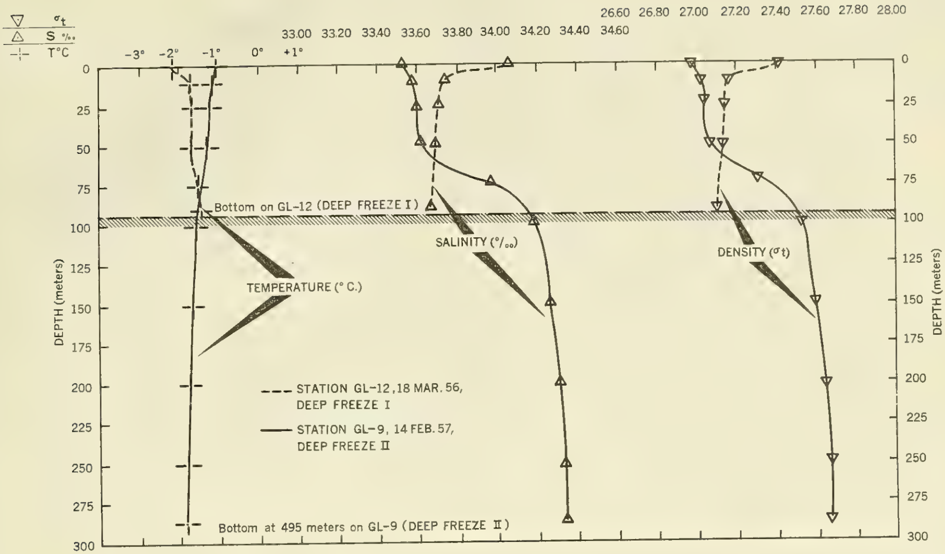


Fig. 9. Vertical distribution of temperature, salinity, and density in Vincennes Bay, USS GLACIER - February 1957



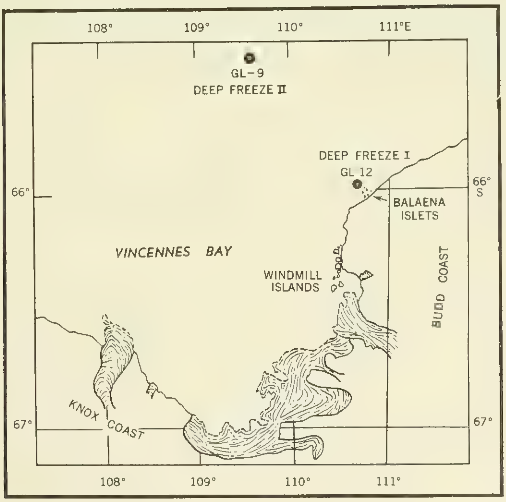


Fig. 10. Comparison of vertical temperature, salinity, and density in Vincennes Bay - March 1956 and February 1957

2. Salinity

Salinity values in the Antarctic Surface Water in the Vincennes Bay region were between 33.27 ‰ and 33.52 ‰ at the surface, and between 34.34 ‰ and 34.49 ‰ at the 300-meter depth.

The salinity gradients were normal and stable (Fig. 9). The salinity distribution was the major factor in the stability and stratification of the water. The lower salinities found toward the surface resulted from melting of old pack ice, fresh run-off of glacial melt water, and any excess of precipitation over evaporation. Figure 10 illustrates the unstable station GL-12 of DEEP REEEZE I compared with station GL-9 of DEEP FREEZE II, and shows results of changing meteorological conditions, freezing and thawing. The freezing process occurring during station GL-12 (DF-I) resulted in considerable salt being added to the surface water, thus creating an unstable density situation. During station GL-9, the same area showed a more normal summer salinity pattern, with less saline melt water mixed with the surface water, resulting in a stable density pattern. This latter condition probably continued until the next period of freezing occurred.

3. Density

Figure 9 illustrates the density structure as calculated from the observed temperature and salinity values obtained. The density structure was stable, implying a preceeding period of thawing conditions. Density values ranged from a minimum sigma-t of 26.79 at the surface to 27.79 off the bottom. In contrast to these stable density conditions, the structure of the previous year is exactly the reverse (Fig. 10). Station GL-12 of DEEP FREEZE I recorded an extremely unstable situation in regard to density values. Station GL-9 of DEEP FREEZE II showed stability. This change resulted from similar changes in temperature and especially salinity.

V. ANTARCTIC CONVERGENCE

A. General

The exact definition of Antarctic Convergence is controversial and considered beyond the scope of this report. However, as the convergence is one of the most interesting oceanographic features in the Antarctic area and forms one of the best criteria for delineating the Antarctic region from the Subantarctic Region, it will be discussed briefly.

For the purpose of this report, the Antarctic Convergence will be considered as the zone where the cold and slightly denser surface water of the Antarctic region sinks below the warmer and slightly lighter surface water to the north. This zone is usually marked by a sharp north-south decrease in the surface water temperature ranging from 2° to 6°F. The mean surface temperature associated with this drop is about 40°F during the southern summer; this gradient (north to south drop) generally is also found at moderate depths. The mean temperature of the convergence surface gradient decreases as winter approaches. At greater depths sinking water mixes with adjacent water and eventually spreads to the north as the Antarctic Intermediate Water Mass, always recognizable by its minimum salinity.

The entire area south of the convergence is typified in summer by a mixed surface layer as deep as 150 feet. Below this, temperatures decrease strongly to a minimum of about 30°F at depths from 150 to 500 feet. At greater depths the temperature increases to as much as 36°F reflecting the presence of the deep warm water mass. Over continental shelf areas the water is generally isothermal below the immediate surface layer. It is emphasized, however, that the main water circulation in the convergence area is west to east, and the north-south movements described above are vectors of small magnitude.

The Antarctic Convergence is not always a clear phenomenon and may not be readily apparent. The most reliable indication of the position of the convergence is given by the first indication, when traveling southward, of a distinct subsurface temperature minimum at moderate depths.

Frequently the surface water characteristics near the convergence will fluctuate or show some irregularity. These may result from eddies, tongues, presence of associated divergences, seasonal or meteorological effects, or other causes.

B. Atlantic Ocean Section

The temperature structure of the Convergence zone extrapolated from BT's taken by the STATEN ISLAND during its southward transit in December

Fig. 11. Vertical distribution of temperature, Atlantic Antarctic Convergence - December 1956 and February 1957

and return transit in February is illustrated in Figure 11. In addition, six representative BT traces have been presented on the chart. The irregularity of some of the traces and the complexity of isotherms in the cross sections is a result of the characteristic sinuosity of the convergence. The letter "A" is used on the chart to show the Antarctic Surface Water with its seasonally heated upper layer while "B" indicates the deep warm water. Despite temperatures warmer than the water immediately above, this mass is of high enough salinity to make it denser than "A".

C. Pacific Ocean Section

In November the GLACIER crossed the Antarctic Convergence at approximately 62°S, 173°E. The BT observations taken during this transit have been used in preparation of Figure 12. This shows clearly the cold Antarctic Surface Water to the south (relatively unaffected by seasonal warming at the early date). Surface salinity samples collected during the BT observations have also been plotted, and from these and temperature values the surface density is also shown.

The thermal profile section presented in Figure 13 was derived from BT's obtained by the ATKA during the southward transit in December. The position of the Convergence was approximately the same as recorded by the GLACIER during its November crossing. Figure 14 illustrates the thermal structure of the surface layers extrapolated from BT's taken during the ATKA's return transit in late February. The position of the Convergence zone was almost the same as in the December crossing; however, seasonal warming raised the surface temperatures considerably. A seasonal thermocline is prominent. As in Figure 13 the shaded zone marks the remains of winter water in the Antarctic Surface Water mass.

D. Indian Ocean Section

Figure 15 shows a cross section through the Convergence taken by the GLACIER during a transit from the Knox Coast to Australia in late February. Here the zone was observed much farther northward then in the Pacific Sector to the east. The illustration portrays well the characteristic horizontal temperature gradient of the surface and the spreading of the colder Antarctic Surface Water northward below the warmer surface water at lower latitudes.

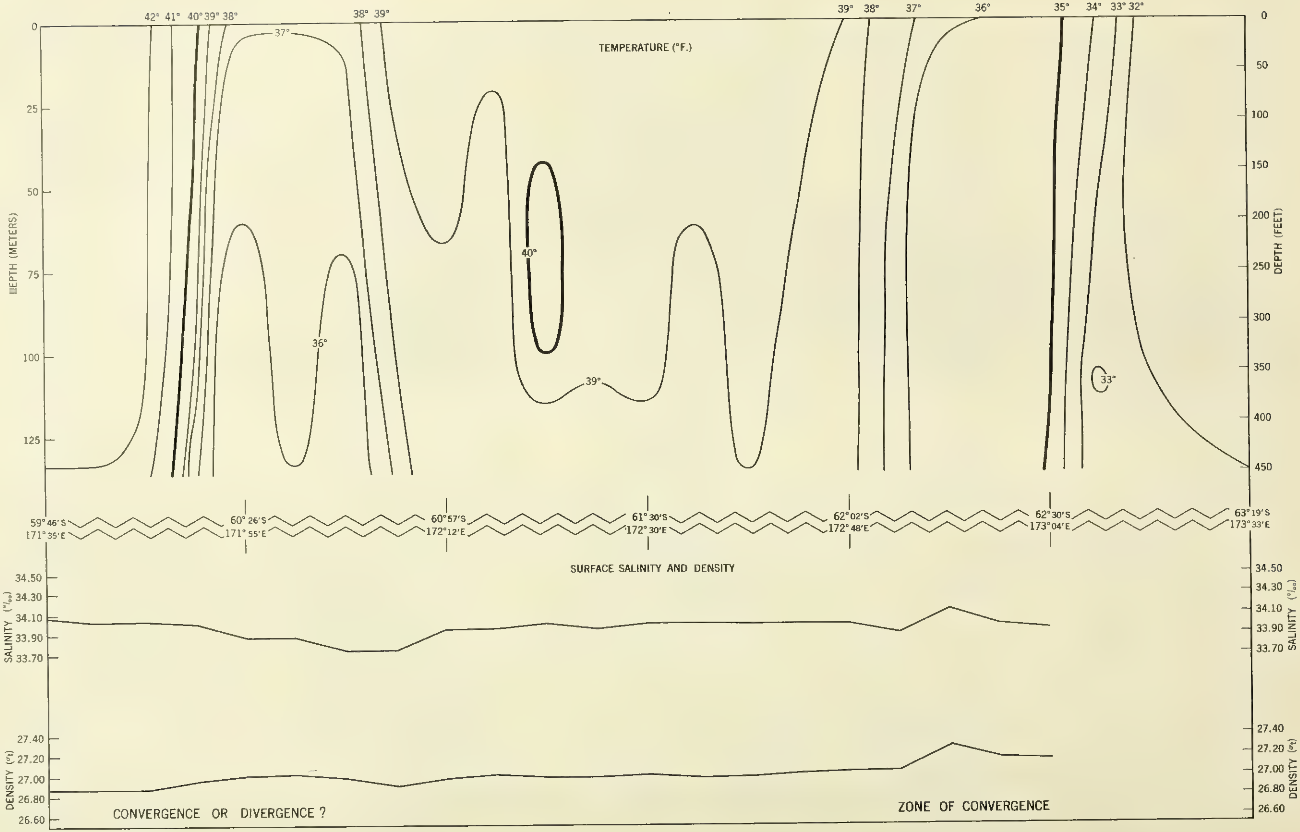


Fig. 12. Vertical distribution of temperature, Pacific Antarctic Convergence - November 1956

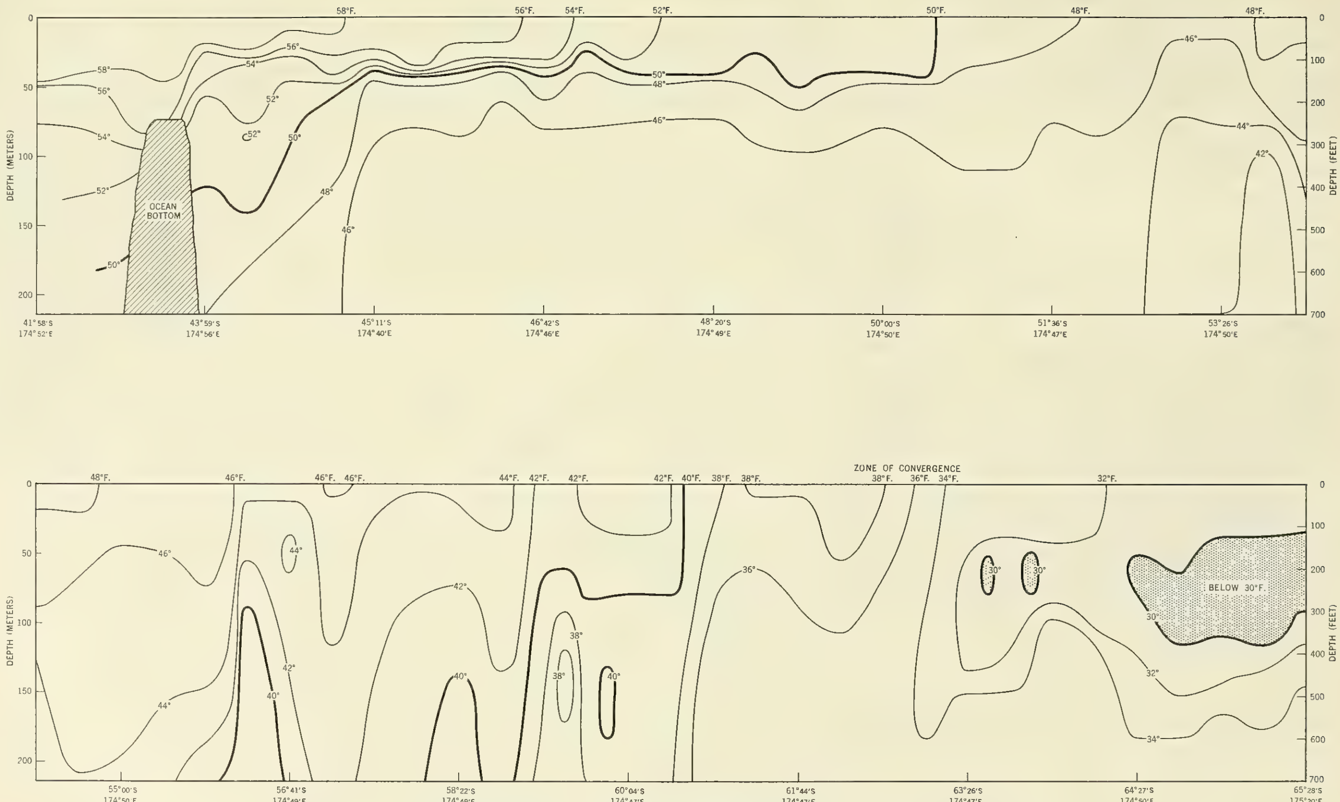


Fig. 13. Vertical distribution of temperature, Pacific Antarctic Convergence - December 1956

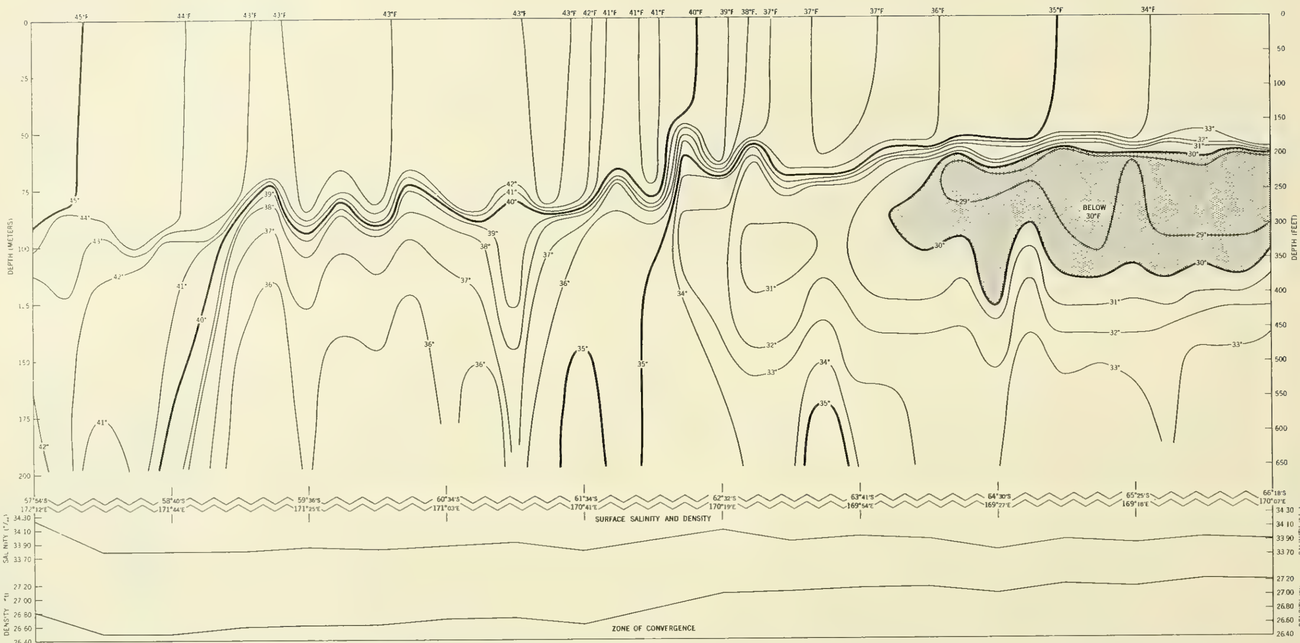


Fig. 14. Vertical distribution of temperature, Pacific Antarctic Convergence - February 1957

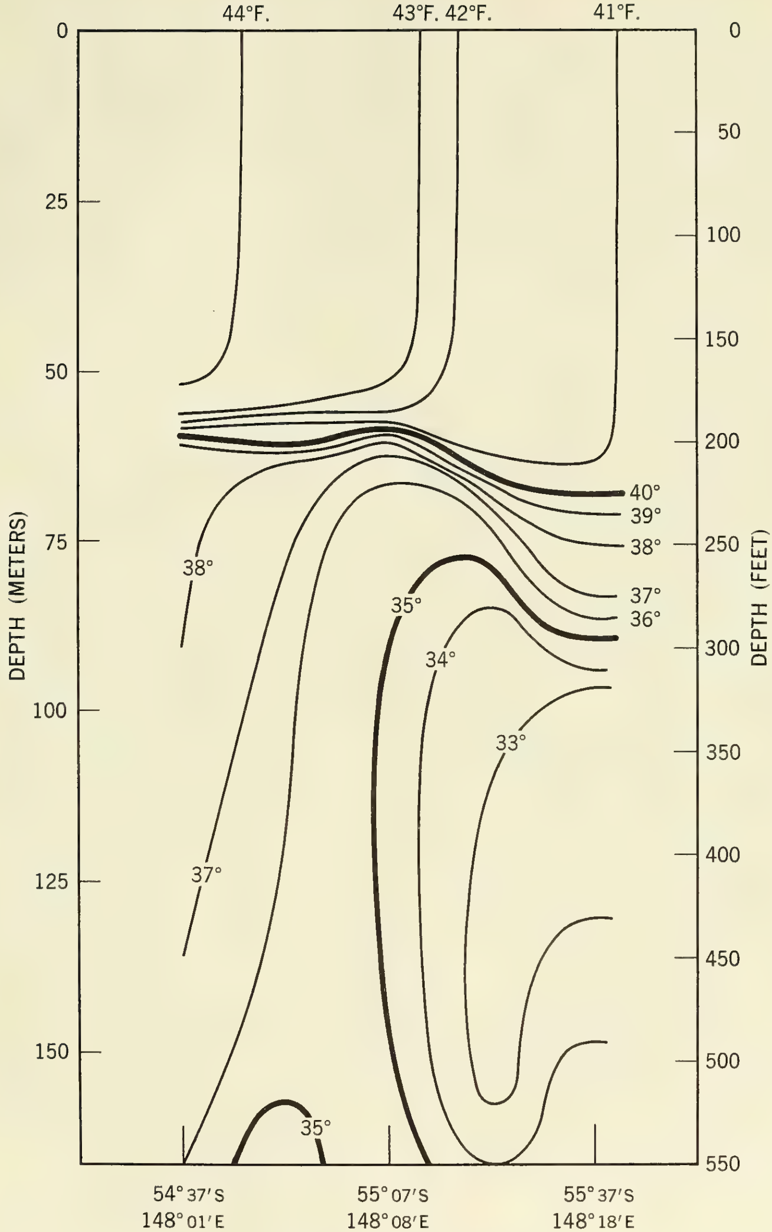


Fig. 15. Vertical distribution of temperature, Indian Antarctic Convergence - February 1957

A. Ice Conditions

Although ice reconnaissance was not one of the primary missions of DEEP FREEZE II, the ice information gathered during the 1956-1957 Antarctic expedition equalled and, in some places, surpassed that collected in previous years. This was the first year that an extensive penetration into the Weddell Sea was made. This report is a compilation of ice information and charts from the U. S. Ships STATEN ISLAND and WYANDOT for the Weddell Sea area, and the U. S. Ships GLACIER, NORTHWIND, ATKA, GREENVILLE VICTORY, CURTIS, NESPELEN, and ENDEAVOR for the Ross Sea area. Ice information is presented on a single chart for the Weddell Sea area and by months for the Ross Sea area.

1. Weddell Sea Area

Ice, in the form of icebergs (possibly grounded), was first observed slightly north of the South Orkeny Islands at 60°18'S, 44°10'W, on 12 December 1956 (Fig. 16). The pack ice perimeter was encountered at about 60°35'S, 37°10'W on 13 December. It was followed roughly eastward to 61°12'S, 14°53'W, where on 17 December the pack was entered on a southeasterly course. Icebergs were very numerous along the entire perimeter. After 10 days in a pack of predominantly close and broken ice, with very little progress being made the last five days because of heavy, consolidated ice, an intermittent coastal lead was reached near 71°25'S, 13°45'W, running southwestward along the shelf. This lead was followed without difficulty to the eastern approaches of Gould Bay (in the southernmost extremity of the Weddell Sea) which was reached on 31 December. Numerous icebergs were observed along the entire route. Outside of the eastern entrance to Gould Bay, heavy pack ice under great pressure by northerly winds prevented extensive ship movement until 11 January 1957 when a narrow lead of open and scattered ice on the eastern side of a 27-mile long berg (probably grounded) outside of Gould Bay was finally reached. After following this lead to the northern end of the berg, fast ice and heavy pack ice was encountered westward until intermittent and narrow leads along the Filchner Ice Shelf were reached. Snow cover on the pack and fast ice with thicknesses as great as 12 feet presented quite a chore for the STATEN ISLAND between the large berg and the shelf. After continuing northwestward in intermittent and very narrow leads in the scattered and broken ice along the Filchner Ice Shelf, no suitable offloading site was found all the way to Cape Adams. The shelf was 100 to 200 feet high at all points west of Gould Bay. The STATEN ISLAND and WYANDOT then retraced their track to the eastern approaches of Gould Bay. The return trip was marked by slightly narrower leads and occasional patches of pack ice in the leads. Again, heavy consolidated pack ice was present west and northwest of the 27-mile-long berg and between

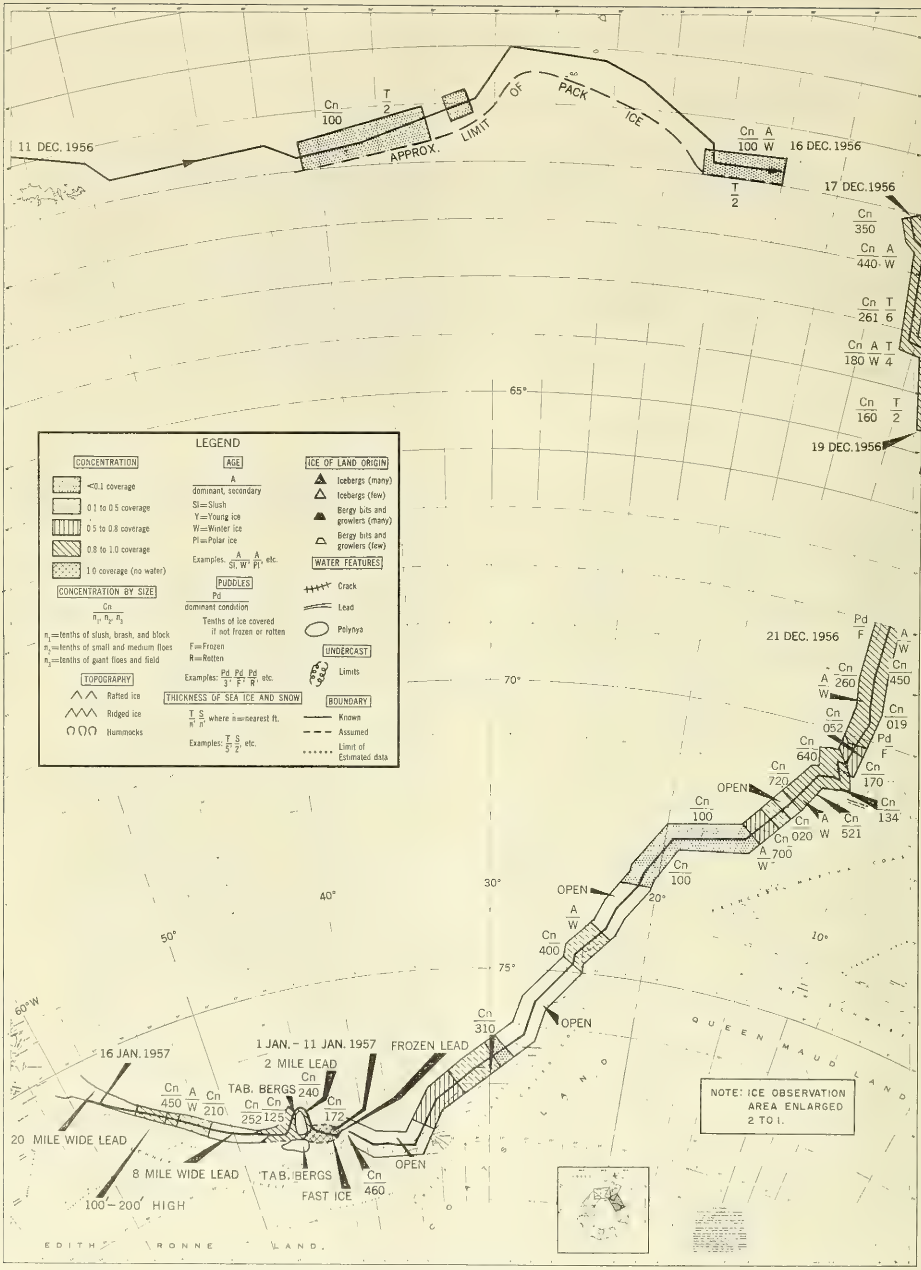


Fig. 16. Ice conditions, Weddell Sea - 11 December 1956 to 16 January 1957

the lead northeast and east of the berg to the shelf east of Gould Bay. On 26 January leads of open water at 77°43'S, 41°07'W, off the east end of Chica Bay, provided the best offloading point for a base site, and was finally reached after having passed the same site almost one month previously. While the airflow at the offloading point was such as to maintain an appreciable shore lead (prevailing southerlies), constant below-freezing temperatures caused the water of the shore lead to freeze to a thickness of 5 to 10 inches. This new ice was present in the shore lead on the departure day, 11 February. Leaving this new ice the STATEN ISLAND and WYANDOT traveled northeastward and soon reached areas of the shore lead that were predominantly open (Fig. 17). On 13 February at about 75°28'S, 27°13'W, an attempt was made to cut northward through the pack. Although less consolidated than during December the pack was still too difficult for the now crippled WYANDOT, necessitating a return to the open water of the shore lead. A northeast course was maintained through open and scattered ice to 71°14'S, 14°21'W, when once again a northerly course was attempted. This time pack ice was negligible and a northwest track was maintained. The last of the pack ice was seen on 15 February at 70°00'S, 15°40'W, but bergs were encountered along the course until 18 February 1957.

2. Ross Sea Area and off the Coast of Wilkes Land

October - From Valparaiso a general southwesterly course was followed as far as the first pack ice. Icebergs were noted on the GLACIER's radar on the morning of 11 October 1956, but were not sighted from the ship until 2230 that evening and several were in sight on the following day. Some grease ice was noted at 0300 on the morning of 13 October, and the edge of the pack ice was entered at 0545 at 62°18'S, 118°45'W (Fig. 18). During the night the air temperature dropped to 10°F, causing extensive icing on the forward part of the ship from heavy seas continuously washing over the decks. All decks were ice covered with two to four inches forming on the welldeck. The pack ice, when first encountered, was predominantly new ice with some fragments of old, winter pack frozen in. Much of it had been pancaked and refrozen, and the concentration was between one and five-tenths. Late in the afternoon of the 13th, heavier ice, four to five feet thick and eight-tenths concentration, was entered. At this point (approximately 124°W) the ship headed northwest to avoid the main body of the pack, which had been slowing its progress considerably, and no further attempts were made to break through the pack ice on a direct westerly route. The ship's passage continued on a course which carried her as far north as about 59°S, 136°W, and then southwest, maintaining a course which roughly paralleled the fringe of the pack ice. The 63° was passed at 162°W (Fig. 19), and from there on a course was maintained between 63° and 64°30'S, until 174°E was reached.

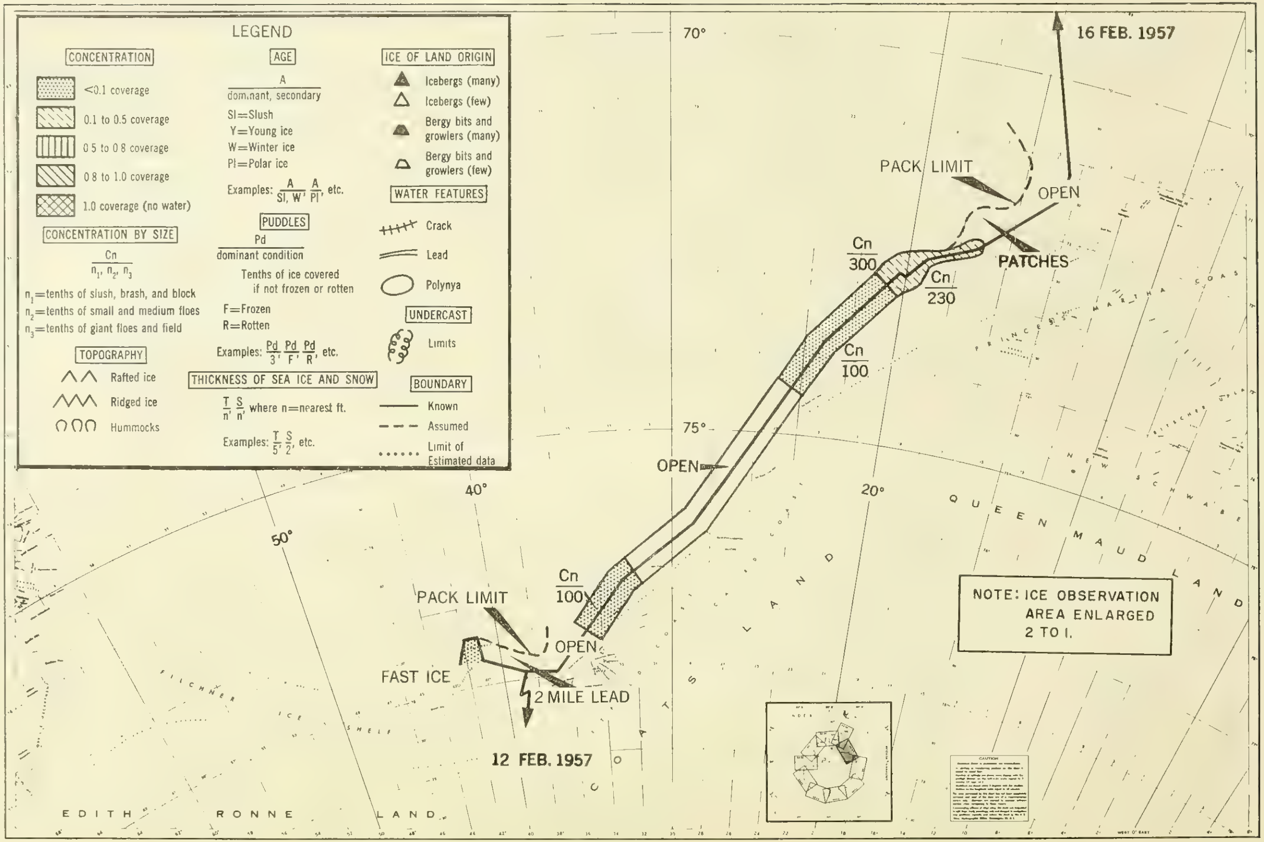


Fig. 17. Ice conditions, Weddell Sea - 12 February to 16 February 1957

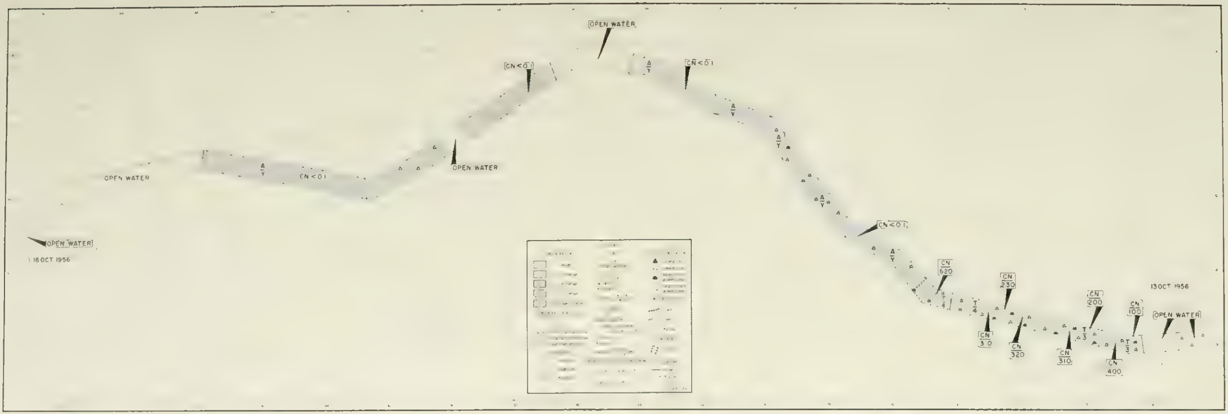


Fig. 18. Ice conditions enroute Ross Sea - 13 October to 16 October 1956

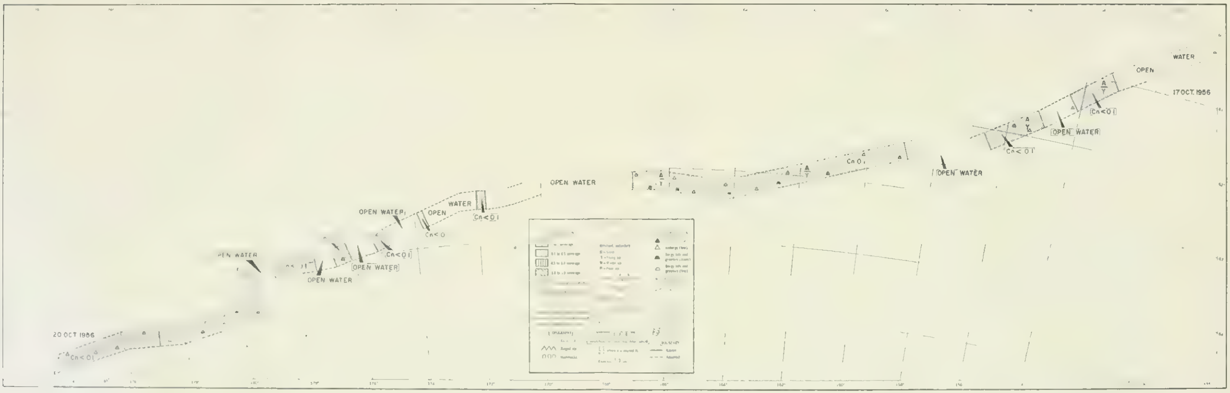


Fig. 19. Ice conditions enroute Ross Sea - 17 October to 20 October 1956

The fringe of the pack ice along this course was composed largely of new sea ice varying in thickness from six inches to two feet, with occasional blocks of old pack ice of five and six feet thicknesses; the pack was universally snow covered. Much of the westward passage was made in open water, although at times rough weather drove the ship back into the pack-ice fringe where the new ice damped the heavy swells or rough seas. On several occasions, however, swells persisted for several miles into the pack fringe. The GLACIER kept well to the north of the main body of the pack, and her track may be taken as the approximate northern boundary of the pack ice at this season of the year. North of the outer margins of the pack, alternate bands of ice and open water were traversed, the bands trending in a general north and south direction. Some scattered small bergs were seen, but they were never numerous. Also, very few bergy bits and growlers were observed; the growlers observed were moving south (relatively) through the light pack.

By 20 October, while near 178°E at about 64°30'S, the first remnants of old pressure ridges were noted (Fig. 20). The GLACIER was now in ice which extended on all sides as far as the horizon, but containing numerous open water patches and a few scattered bergs. The ice was mainly new with a few blocks of old pack ice here and there which were from 4 to 6 feet thick; the ice in old pressure ridge remnants was 10 to 12 feet thick. Several good sized bergs of the pinnacled variety were passed. At about 64°30'S, the ship headed due south along 174°E.

On 21 October, heavier ice, forming the northern edge of the main pack ice of the Ross Sea, was encountered by GLACIER at 66°15'S, and forty miles farther south this changed to consolidated ice of ten-tenths concentration. A few leads trended in a north and south direction, but, when followed, either soon ended in wide consolidated ice fields or in pressure ridges. Here the ice was visibly under pressure, and although it was not generally more than two or three feet thick, some blocks at least ten feet thick were seen; all ice was heavily snow covered a foot or more. Soon, pressure ridges running in all directions were encountered which were hard to get through. These ice conditions persisted through 22 October, but on the 23rd at about 70°S, the ice became considerably lighter and more open leads appeared. Off Cape Adare, another patch of consolidated ice was passed through, and south of this point occasional stretches of heavier ice were encountered. As Coulman Island was approached, conditions appeared very favorable for a fast passage to McMurdo Sound. Just east of Coulman Island however, a difficult area of consolidated ice was encountered which stopped the ship for over an hour. The ice here was four to five feet thick and under considerable pressure.

The GLACIER, by this time, reached a position of about 73°10'S, and from here on the pack ice became increasingly more difficult to pass through. While at first, leads and open water areas were frequent,

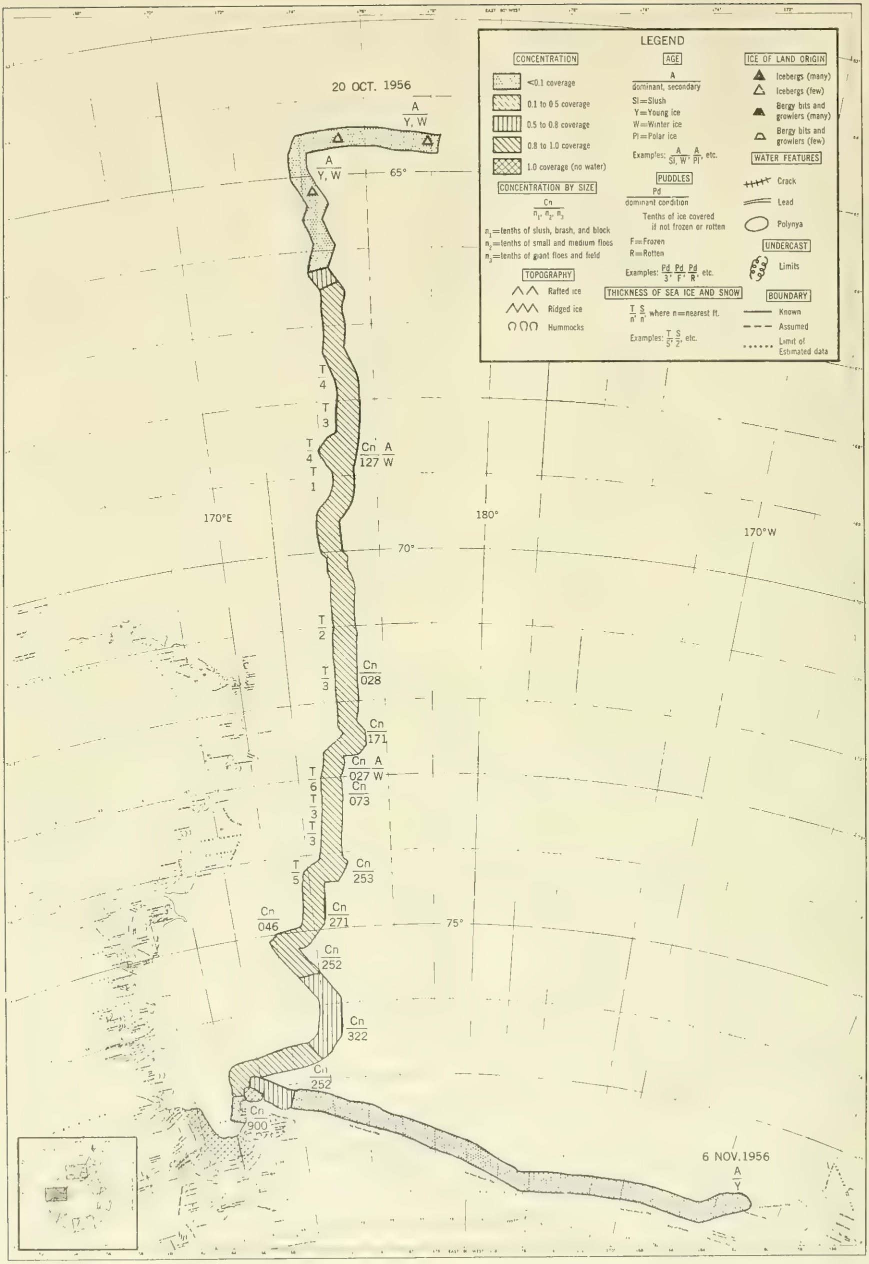


Fig. 20. Ice conditions, Ross Sea - 20 October to 6 November 1956

the ice between was composed of broken and refrozen blocks which offered considerable resistance to the ship's progress. No bergs were seen during the two previous days, but on the morning of the 25th of October, about one half mile west of a lone, tabular berg, the ship became stuck in a patch of consolidated ice which required six hours to make four miles southing. The ice was four to five feet thick in the level portions, but many pressure areas with ridges and hummocks were present. Little progress was made on the 25th, and on the afternoon of the 26th, after several hours had been expended in breaking through a heavy pressure ridge, more favorable ice was encountered. Leads were infrequent and trended mainly in an east and west direction; they were usually refrozen with a foot or two of new ice.

By 27 October the GLACIER reached approximately 76°S. Here, the ice became comparatively easier to traverse and more frequent leads occurred. Progress was still slow through the ice,which, while it was not more than two or three feet in thickness, was heavily snow-covered. At about 1000 on the morning of the 27th, course was gradually shifted to the west through ice one to two feet thick but still heavily snow covered, and predominately new. Just before reaching 168°E, north of Beaufort Island, a patch of more consolidated ice was passed through. This was left behind when the ship headed due south to pass Beaufort Island on the west. Open water areas became more frequent and just northwest of the island, almost completely ice-free water was entered. This was followed to Cape Bird and on into McMurdo Sound late in the afternoon of 28 October 1956. The large tabular berg which had been noted during last year's cruise was still in its original place, tied fast to the east of Cape Bird by fast ice and to Beaufort Island to the north and west by more fast ice. Apparently this huge block of ice, measuring some twelve by fifteen miles in extent, may remain fixed in its present position for some time to come. Nothing short of an extremely severe seismic disturbance, or extensive storm conditions can possibly move it from its place at the northeast approach to McMurdo Sound. Here it produces a marked interference with the normal current pattern of the area and must contribute greatly in the prevention of normal clearing of fast ice from the sound.

The GLACIER's experience with the ice in late October in the western Ross Sea, almost two months earlier than previous records, resulted in some interesting summary observations as to ice conditions at this early date. In general, the ice, except at pressure ridges, or in places where rafting or broken and refrozen ice was met with, was never very thick. A measured thickness, obtained by blowing holes with 15-pound shaped charges, gave five feet on the level, with eight feet near a pressure ridge. These measurements were made on 26 October while the ship was beset at one of the most difficult places encountered. Most of the ice scarcely exceeded three to four feet in thickness as measured with a graduated duraluminum rod from the welldeck. Frequent blocks of ice were ten or even more feet in thickness, but the general

ice cover was not unusually heavy. However, the ice was not the soft, rotten summer ice heretofore encountered in the Ross Sea during the months of December and January in previous crossings. It was hard, tough, and very difficult to crack. Near zero air temperatures (6° to -6°F) increased the toughness of the ice to a condition resembling a mixture of plastic and obsidian. The heavy snow cover, moreover, cushioned the breaking force of the ship to a high degree and made crossings between leads a difficult procedure, requiring much backing and ramming. Helicopters were employed repeatedly throughout the most troublesome areas, to scout more favorable ice and possible leads.

The possibility of traversing the Ross Sea ice pack during the winter season has long been the subject of much controversy. The GLACIER's late October passage may offer some pertinent additional observations as to the feasibility of such an attempt. During the winter months, air temperatures considerably lower than those experienced in October would toughen the ice to an even greater extent. A further obstacle would be the inability to scout for leads and more favorable ice conditions during the darkness of the midwinter months. Any attempt at traversing the Ross Sea pack ice during the winter months would be a most difficult and time-consuming operation, but still not impossible for an icebreaker of the GLACIER class.

The edge of the fast ice on 28 October 1956 in McMurdo Sound extended from just south of Cape Royds west across the sound to within about ten miles of Butter Point. From here it followed north along the Victoria Land coast at approximately this same distance from the shore. At the edge of the fast ice, the thickness was measured and found to vary between two and three feet. To obtain a suitable safe off-loading area, a channel was broken south to a point one and one-half miles west of Inaccessible Island, where the ice was four to five feet thick. Some new ice formed north of the fast ice edge during the week the GLACIER remained at McMurdo Sound.

November - On 5 November 1956, the GLACIER left McMurdo Sound for Little America V at Kainan Bay. Some broken pack ice was passed through in getting out to Beaufort Island and this continued until Cape Crozier was reached. Some open water occurred to the west and north of Beaufort Island, which was rounded from the west at a distance of not more than 200 yards from shore. The remainder of the passage to Little America was made in open water containing only a light covering of grease ice in places. The ship's track closely followed the edge of the Ross Ice Shelf. The Bay of Whales was filled with fast ice, which was about three feet thick at the northern edge. Kainan Bay was also filled with fast ice, which was known to have frozen since April 1956, but which had attained a thickness of about ten feet -- a remarkable growth for only seven months freezing time. The thickness of the ice in Kainan Bay was measured at five holes

blown through the ice with 40-pound shaped charges, from its northern limit to the center of the bay.

Leaving Little America V on 8 November 1956, after passing the western entrance to the Bay of Whales, a course of 300°T was set which brought the ship to the edge of the pack ice at about 76°S, 175°E (Fig. 21). The water from Kainan Bay to this point was open except for some thin, new ice and grease ice. At 175°E the ship's head was turned due north and this approximate longitude was followed during the passage through the Ross Sea pack ice. The ice encountered continued to be new and thin. In places it had been rafted, but otherwise was not more than four to six inches thick, with a light covering of snow. On 10 November the ice became slightly heavier at about 74°45'S; a patch of consolidated ice one to three feet thick was passed through only after some backing and ramming. Further north wide leads extended in all directions. More heavy ice was encountered on the afternoon of 11 November (between 69°12'S, and 68°50'S) retarding the ship considerably. This pack was consolidated, three feet thick, and with one foot of snow cover. The leads were few in number and very irregular. The ship was forced to back and ram repeatedly to break its way through this ice. North of about 67°S however, only rotten ice, one to two feet thick and with six inches of snow cover, was encountered, offering little resistance. The northern edge of the pack ice was left behind at 64°10'S, 175°04'E. A giant berg, 60 miles in length, was encountered at this point. Relatively few bergs were encountered along the ship's track from Little America prior to this encounter.

December - On the return trip from Port Lyttelton, New Zealand, to McMurdo Sound, the first bergs were seen on radar at 0545 on 15 December, and by 1500 of that afternoon, growlers and bergs were visible from the ship. The fringe of the pack ice was entered in the early afternoon of 16 December at 65°32'S, 175°20'E (Fig. 22). The ice concentration was only two-tenths and the thickness about one foot, but five miles south of this point the concentration increased to seven-tenths, and at 67°10'S, the coverage was eight-tenths. The thickness remained about the same except for occasional blocks of older pack ice, which were from three to four feet thick. By noon of the 17th the concentration had increased to nine-tenths and the average thickness was three to four feet, with a six-inch snow cover. Leads were numerous. These conditions remained about the same until the morning of the 18th at 70°S, where open water areas became more numerous and the ice thinned to two feet, offering very little resistance. At 70°25'S, a five-mile stretch of nine-tenths concentration was passed through, the ice being about four feet thick. From here on the ice thinned out considerably, and at the edge of the pack, which was reached at 2300 on the 18th at 72°09'S, 177°30'E, it was barely a foot thick.

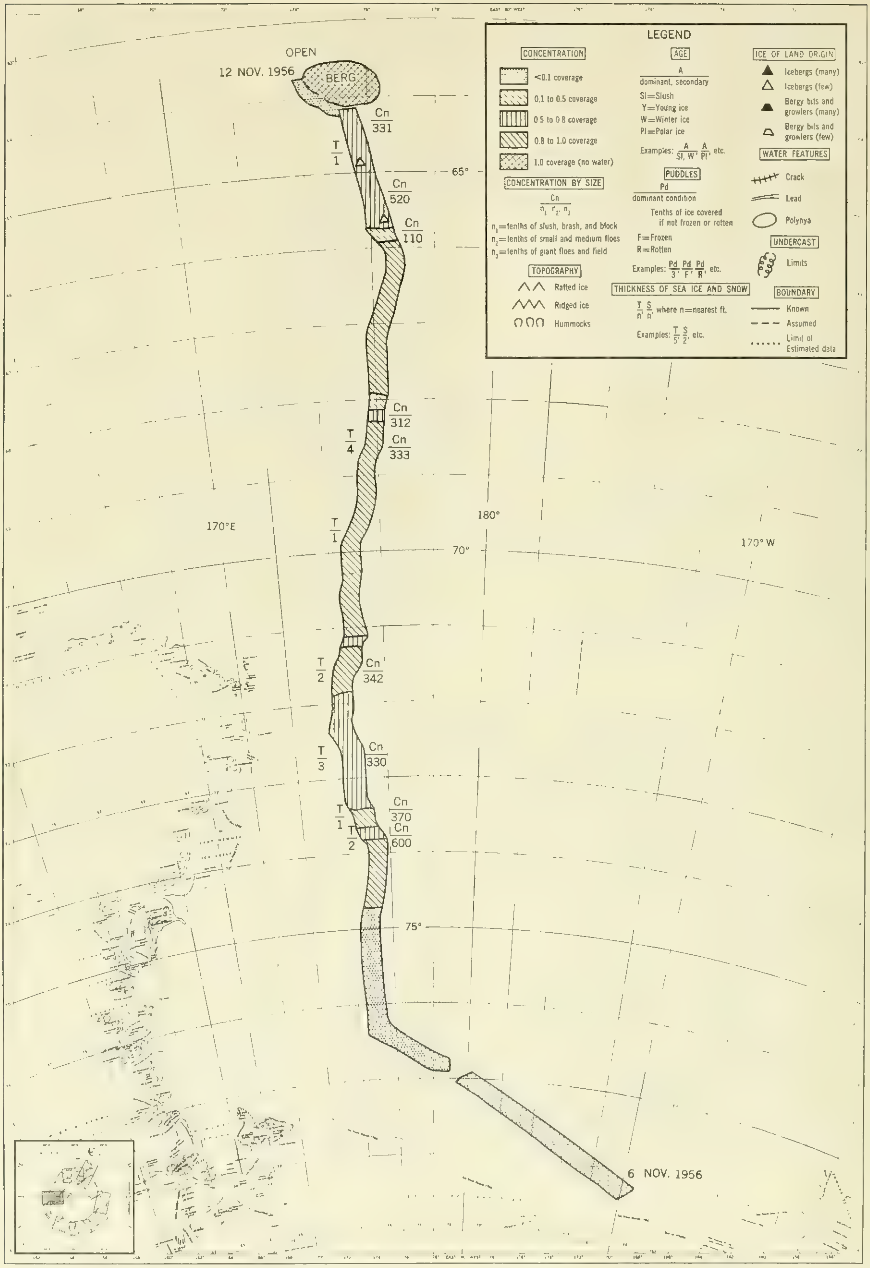


Fig. 21. Ice conditions, Ross Sea - 6 November to 12 November 1956

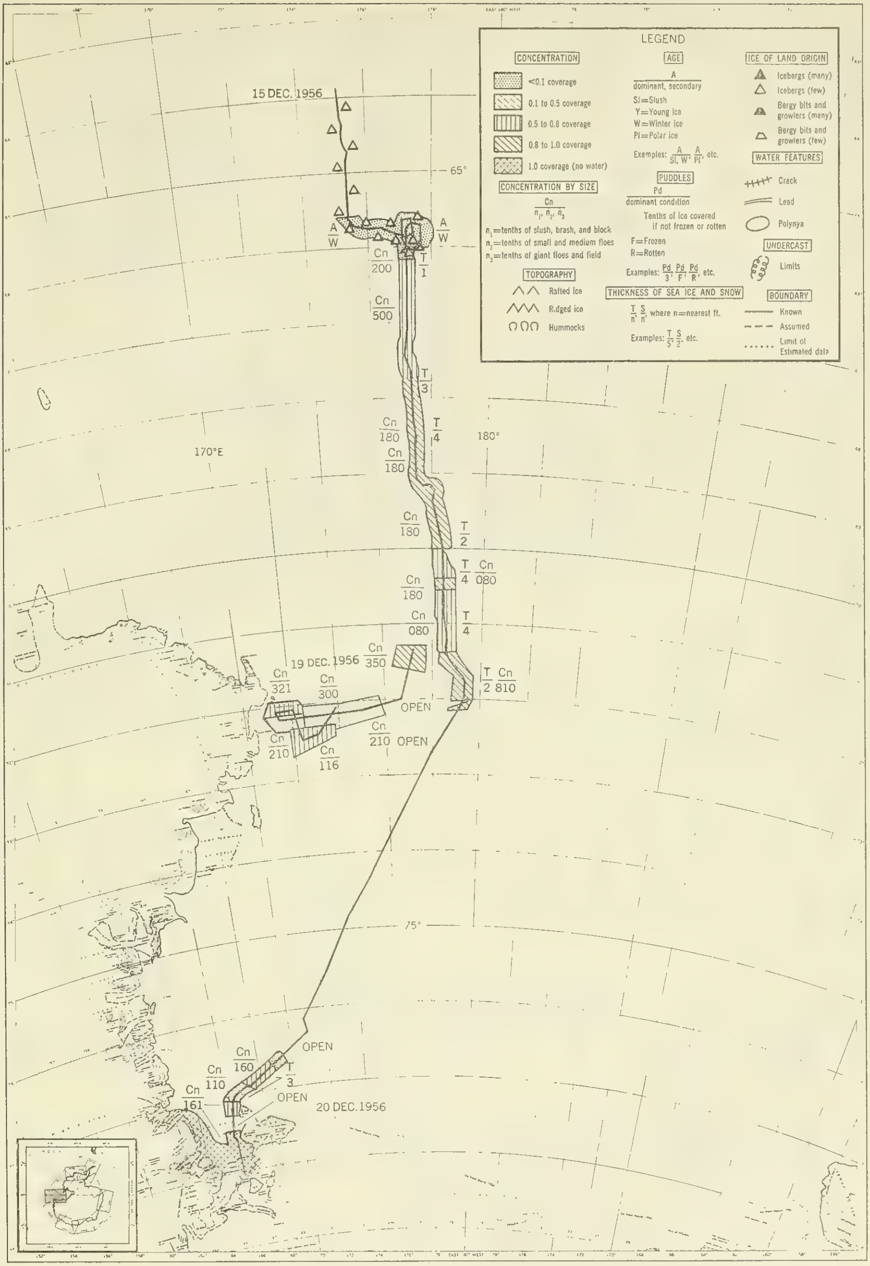


Fig. 22. Ice conditions, Ross Sea - 15 December to 20 December 1956

In the southern Ross Sea the ship remained in open water until southeast of Franklin Island, where some ice was entered at 0500 on 20 December at 76°30'S, 169°35'E. The main concentration of the offshore pack ice was entered one hour later. The ice here was two feet thick and seven to eight-tenths concentration. Ice had moved in from the north but some open water remained until north of Cape Royds where refrozen pack was met. Heading west, within McMurdo Sound, open water was soon regained. Some broken and refrozen pack occurred at the edge of the fast ice, which was in the same position as it had been in early November (Figs. 23 A and B). More ice moved in on the afternoon of the 20th, packing itself around the NESPELEN; assistance from the GLACIER was required to free her.

Breaking into the fast ice in McMurdo Sound began on 21 December and proceeded along somewhat different lines than those employed in Operation DEEP FREEZE I. The previous year, a long, more or less straight channel was broken out to within four miles of Hut Point. The ice in the channel almost immediately froze solid and required re-breaking every time a ship moved. As a result, the cargo ships were never taken down the channel. This year, however, after driving a wide channel due south, the ship cut back at a 60-degree angle toward the northwest, thus cutting the outline of a large "V" with the wide end toward the north. More channels were then cut farther south and to the west and several cross lines were made through the fast ice to break the wedges into smaller sectors. Several days of calm weather followed completion of these channels, but finally on 28 December, the long awaited southerly wind came and by 1500 was blowing 30 knots from 140°T. This soon cleared an open channel 200 yards wide from a point about eight miles north of Hut Point to the edge of the fast ice and took out most of the wedge-shaped sectors of fast ice. The cargo ships then came down the channel to offload.

Meanwhile, the ATKA weighed anchor for Little America V early on 27 December 1956. Consolidated sea ice with many rafted floes was encountered in the vicinity of Beaufort Island (Fig. 24). The ice appeared as a long tongue extending northward from Ross Island to Beaufort Island, thence northward to the limit of visibility. The sea was so congested that the forward progress of the ATKA was delayed for almost two hours on the afternoon of the 27th. East of 168°40'W, ice-free water was reached and the track remained ice free to the destination, which was reached early on 29 December. Kainan Bay was covered by fast ice attached to the ice barrier, but because it was disintegrating rapidly, it had practically disappeared by 1 January 1957.

Upon the return journey from Little America V to McMurdo Sound, the ATKA found little sea ice to impede its progress in the lead along the Ross Ice Shelf. The consolidated ice encountered on the outbound

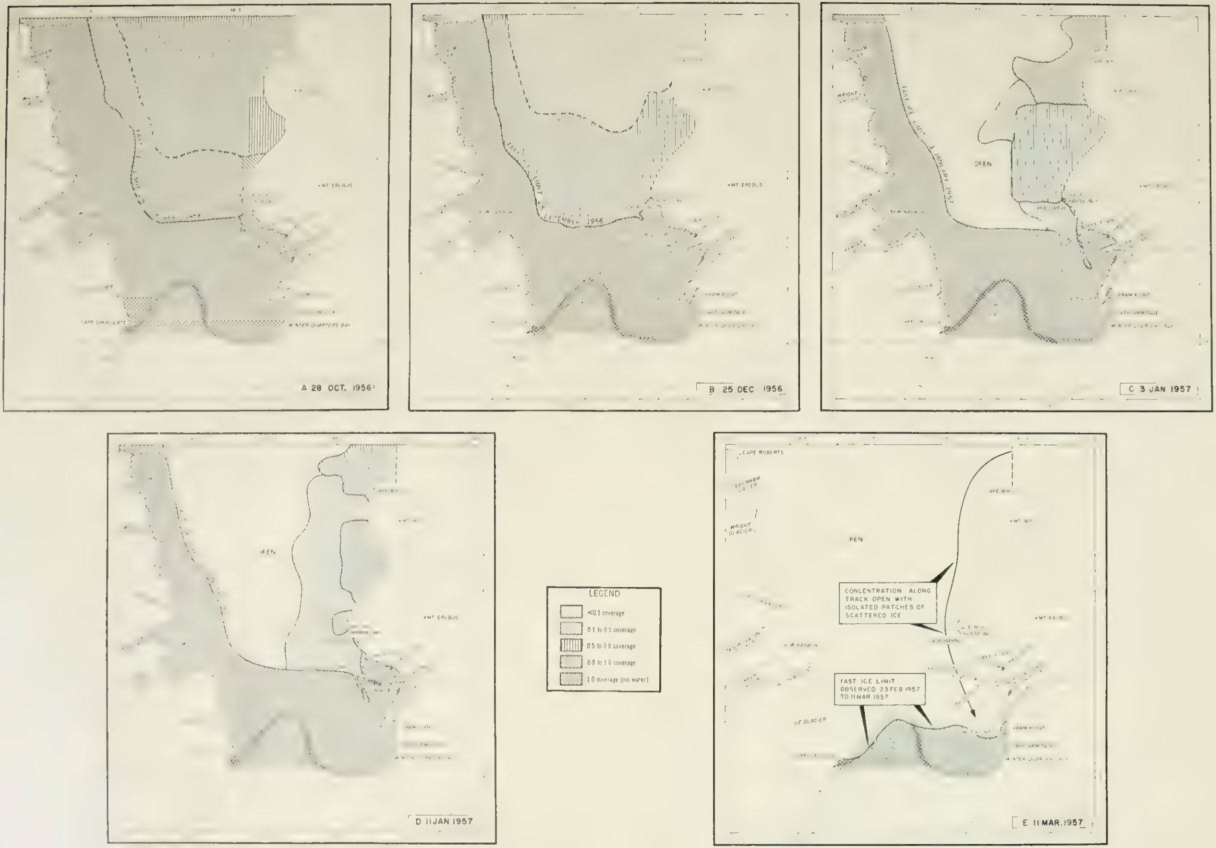


Fig. 23. Ice conditions, McMurdo Sound

leg along the western side of Ross Island and Beaufort Island had disintegrated to approximately one-tenth surface coverage of predominantly growlers and brash.

January - During the time the GLACIER remained in McMurdo Sound, from 20 December to 15 January, studies of the changes in the fast ice of the area were conducted by regular flights in the small Otter plane and by helicopter. Little change in the general picture occurred during that time; the fast ice broke away along the eastern shore of the sound and by 15 January, the fast ice edge ran from Cape Barne south to the western shores of Inaccessible and Tent Islands (Figs 23 C and D). A large open water area immediately off Cape Evans was not connected with the open water of the sound at that date. A wide, open crack also stretched from Tent Island across to Glacier Tongue. The fast ice edge ran from Tent Island west to the edge of the channel, and from here it swept in a general northwesterly direction to within ten miles of Butter Point, much as it had been in late October.

Several flights were also made to the old ice area south of Cape Armitage and the Dailey Island region. Except for a few hundred yards off Pram Point, where pressure ridges show the old junction line and a twenty-foot difference in elevation, no remnant of the old shelf ice cliff of five to twenty feet in height reported by Scott was apparent. Melt water from the southwest had overrun the area and frozen, snow had accumulated, and the whole area is now a smooth plain of snow and ice. The only junction lines now visible are the broad V-shaped lines converging on the tip of the morainic mass extending north from Brown Island (Dailey Islands), which represent successive southern limits of the fast-ice break out.

On 15 January 1957, the GLACIER left McMurdo Sound, with the ARNEB, GREENVILLE VICTORY, and NESPELEN in convoy, to rendezvous with the CURTISS north of the pack ice. The scattered and broken pack, which filled a large part of McMurdo Sound north of the fast-ice edge on Sunday, now, two days later, had mostly moved north, leaving an open water channel to a point just southwest of Cape Bird, where some block and brash were transitted. The ship passed west of Beaufort Island. A light concentration of small floes was transitted before leaving the northern edge of the offshore pack fringe at 76°32'S, 167°00'E (Fig. 25). The ship sailed through open water until 1530 on 17 January, when the southern edge of the Ross Sea pack was entered at 69°50'S, 177°00'E. The extent of the pack was much restricted on this passage, only about 80 miles of thin, rotten ice, two to three feet thick, much honeycombed and from one to eight-tenths concentration being encountered. The same conditions prevailed on the return trip after meeting the CURTISS at about 66°50'S, 176°35'E. On leaving the CURTISS, the GLACIER headed northwest from about 69°38'S, 177°00'E, going through the same concentrations and thicknesses of ice as had

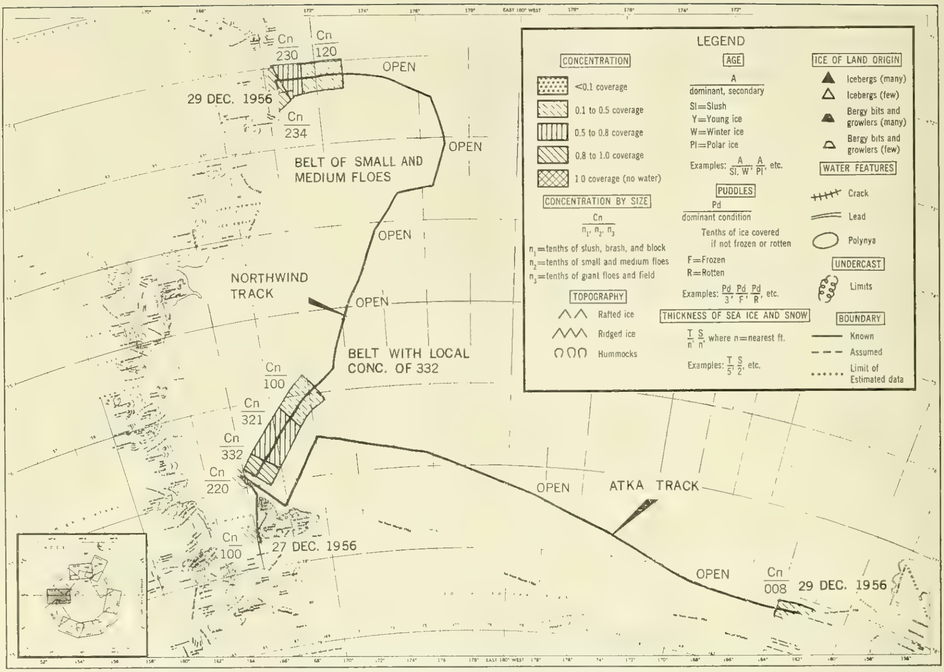


Fig. 24. Ice conditions, Ross Sea - 27 December to 29 December 1956

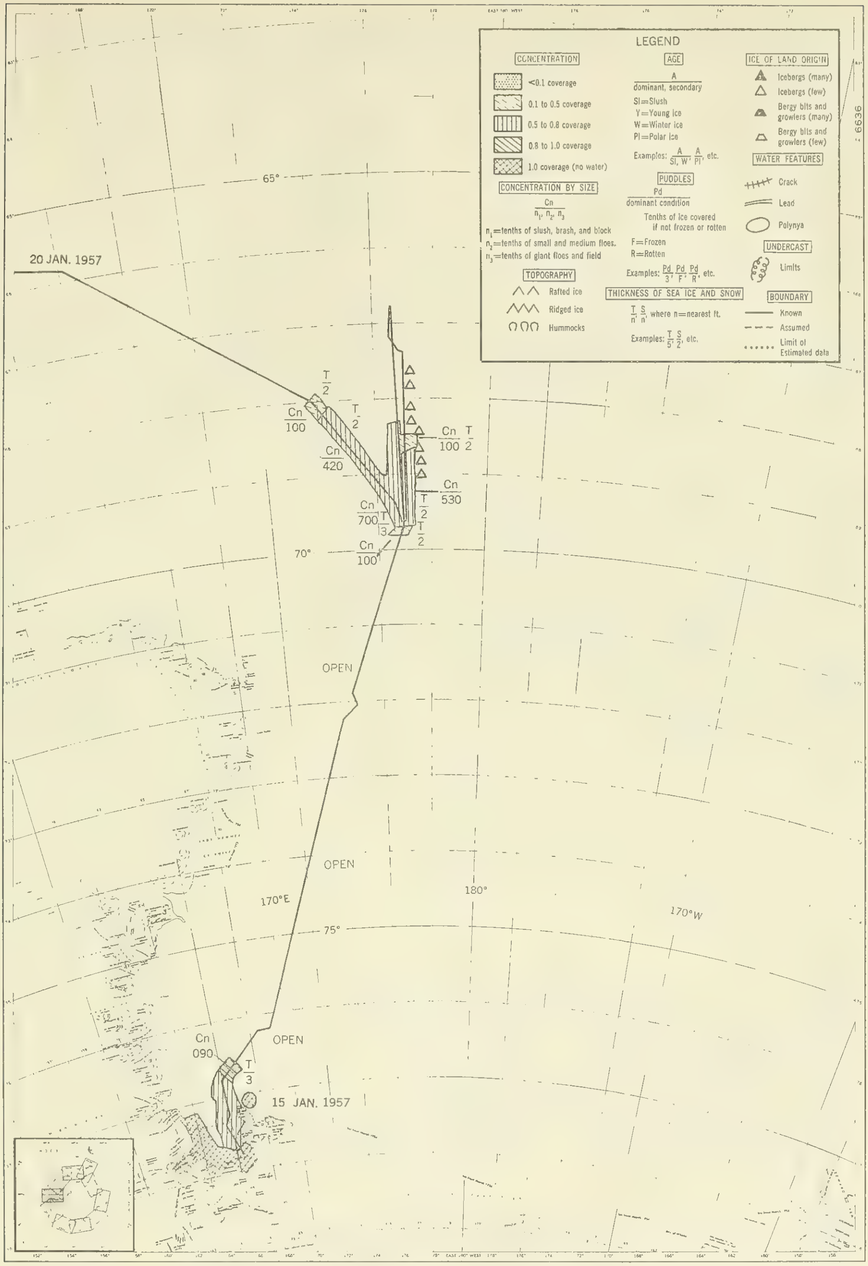


Fig. 25. Ice conditions, Ross Sea - 15 January to 20 January 1957

been passed through on the northern and southern courses. The northern edge of the pack was reached at 68°00'S, 173°45'E, at 2200 on 19 January 1957.

From this point, after leaving the ice, the ship continued on a course which took her north of the Balleny Islands and to 64°30'S, 152°30'E, on 21 January. No ice was seen from the edge of the pack ice to this position, and only a few bergs were sighted between 156° and 158°E. Course was then kept along 64°30'S westward through open water until just east of the entrance to Vincennes Bay. No ice was seen, but a few bergs were observed between 137°E and 133°E off the Adelie and Clarie coasts. At 114°E, the ship's course was altered to the southwest to take her to the edge of the pack ice. The edge was encountered at about 64°50'S, 112°00'E (Fig. 26), and was followed westward into a small indentation in the pack. Here, the Danish ship KISTA DAN carrying the Australian expedition was met early on the morning of 25 January 1957.

Leaving the KISTA DAN a little after 0900 on the morning of 25 January, the GLACIER headed south and then southeast at about 109°30'E, heading into the pack ice guarding the entrance to Vincennes Bay. At first the ice consisted of light pack with only one berg in sight. An hour later the ice became much heavier, two to three feet thick and seven-tenths concentration. By afternoon it had reached nine-tenths concentration, was snow covered from one to two feet, and many large blocks of very thick ice rose two to three feet above the water. Several convex-topped bergs came into view, and at 1900 a solid line of bergs stretched across the path ahead of the ship. The ice became increasingly thicker and more concentrated with very little open water. The ice averaged three to four feet in thickness, but in old pressure ridges it was considerably thicker, rising out of water four to six feet of which three feet appeared to be compacted snow. Fortunately, the ice was not completely consolidated or it would have been next to impassible. During the night the ship drove her way southeast, almost reaching the coastal lead which could be seen ahead.

The next day, 26 January, the ship, after breaking out a path for the ARNEB and GREENVILLE VICTORY, passed through a most amazing conglomeration of ice. The average thickness appeared to be between five and ten feet, but some of the ice was not more than two or three feet thick, while small floes up to 100 feet or more in diameter were at least 20 to 25 feet thick. An abundance of block and brash, bergy bits, growlers, convex-topped bergs, castellated bergs, and sharp-peaked-pinnacled bergs were scattered throughout. The ice had been moved together, then evidently refrozen in a strangely hummocked and rafted condition. It showed clear evidence of having been under

pressure from northerly winds for some time. In the afternoon of the 26th the cargo ships were left behind and a path was broken around the line of bergs to the east, beyond which open water with alternate strips of ice was encountered. By 1800 a strip of fast ice was met, the northern edge of which extended southwest along the shore of Budd Coast north of the Balaena Islets. These three small rocky islands could be seen a few miles to the southeast surrounded by fast ice. Following a lead northeast along the edge of the fast ice, progress was made for a time, but ice again blocked the ship's path to the north. The ship then headed back, retracing her former route, and finally, after having broken through ice which had just closed some of the previously open leads, she headed north along the 110°40'E meridian. Here, easily navigable ice was transitted, two to three feet thick and mostly block, brash and small floes, some of which were 15 to 20 feet thick and covered with snow to a depth of four feet. Scattered ice was reached by 0845 on the morning of the 27th, and the cargo ships were excorted to the northern edge of the pack. The GLACIER then headed west through open water and made a second attempt to penetrate the pack at 108°E. Heavy, consolidated ice was soon reached and a third attempt was tried at 106°E, with the same results.

On her fourth attempt, at 109°E, the GLACIER was successful in finding a way suitable for convoying the cargo ships through the pack ice. Going on alone on the 28th, the ship passed the line of bergs after transiting an almost solid pack of broken and refrozen ice, averaging two to three feet in thickness and with one to two feet of snow cover. That night the ship broke through the pack ice into open water near the head of Vincennes Bay and proceeded to Holl Island. Holl Island was surrounded by open water, as were all of the Windmill Islands except those like Mitchell, Clark, and Bailey which are tied to the mainland by a continuation of the continental ice shelf. Following a one-day reconnaissance of the islands in order to select a base site for Wilkes Station, the GLACIER left Holl Island at 2030 on the night of 29 January and returned to bring the cargo vessels in. The return passage was made through ice similar to that transitted originally, and the ships were successfully brought to the anchorage off Clark Island at about 1000 on 31 January. On this date and for nearly two weeks following the arrival of the ships, open water completely surrounded the northern Windmill Islands.

February - On 14 February a quick trip was made out through the pack ice to conduct a reconnaissance preliminary to taking the cargo ships out for the passage north. Nearly ice-free water was traversed at first until at 65°53'S, 110°13'E a solid, consolidated mass of ice was encountered which brought the ship up short (Fig. 27). Edging away from this ice to the west, and entering fairly loose pack, the ice was left behind at about 65°21'S, 109°30'E. Following a more westerly route on the return passage south, ice of not more than eight-tenths

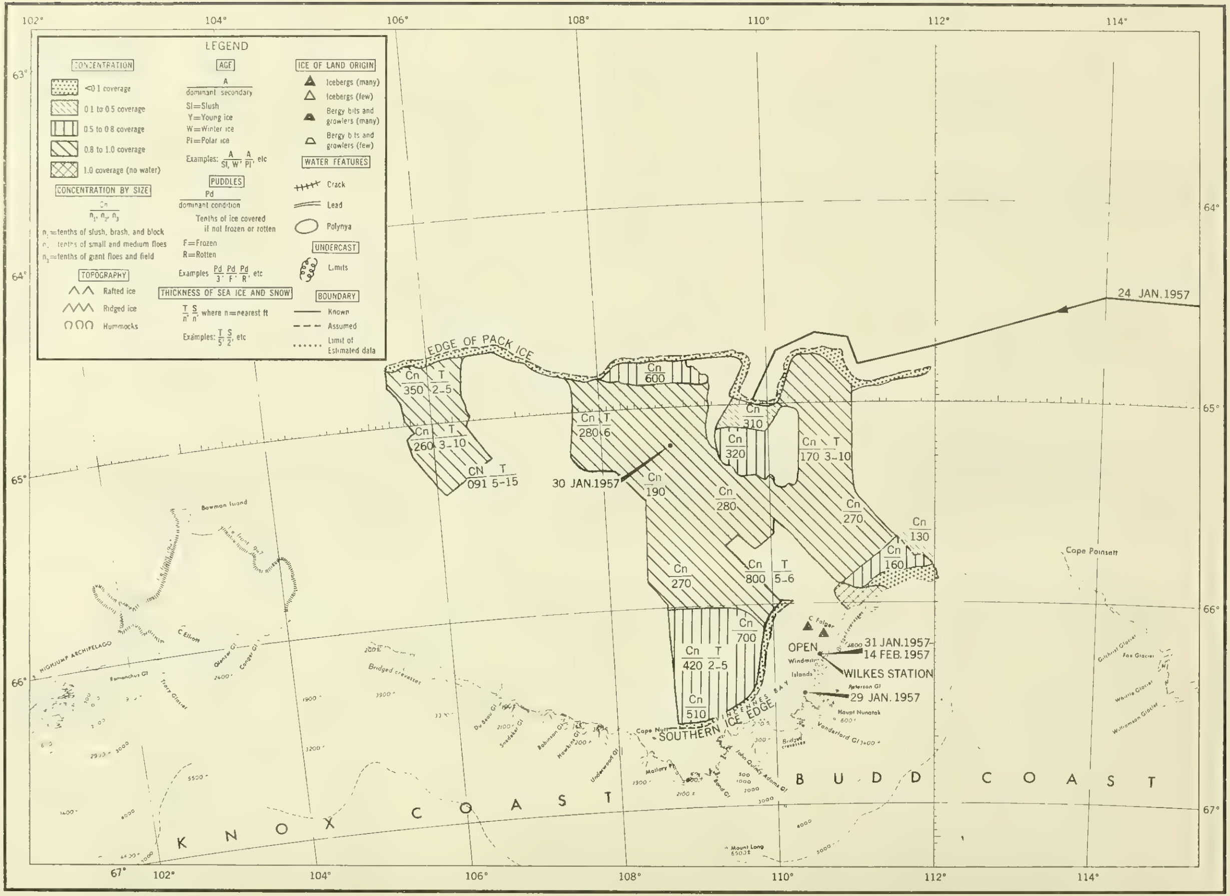


Fig. 26. Ice conditions, Knox and Budd Coasts - 24 January to 31 January 1957

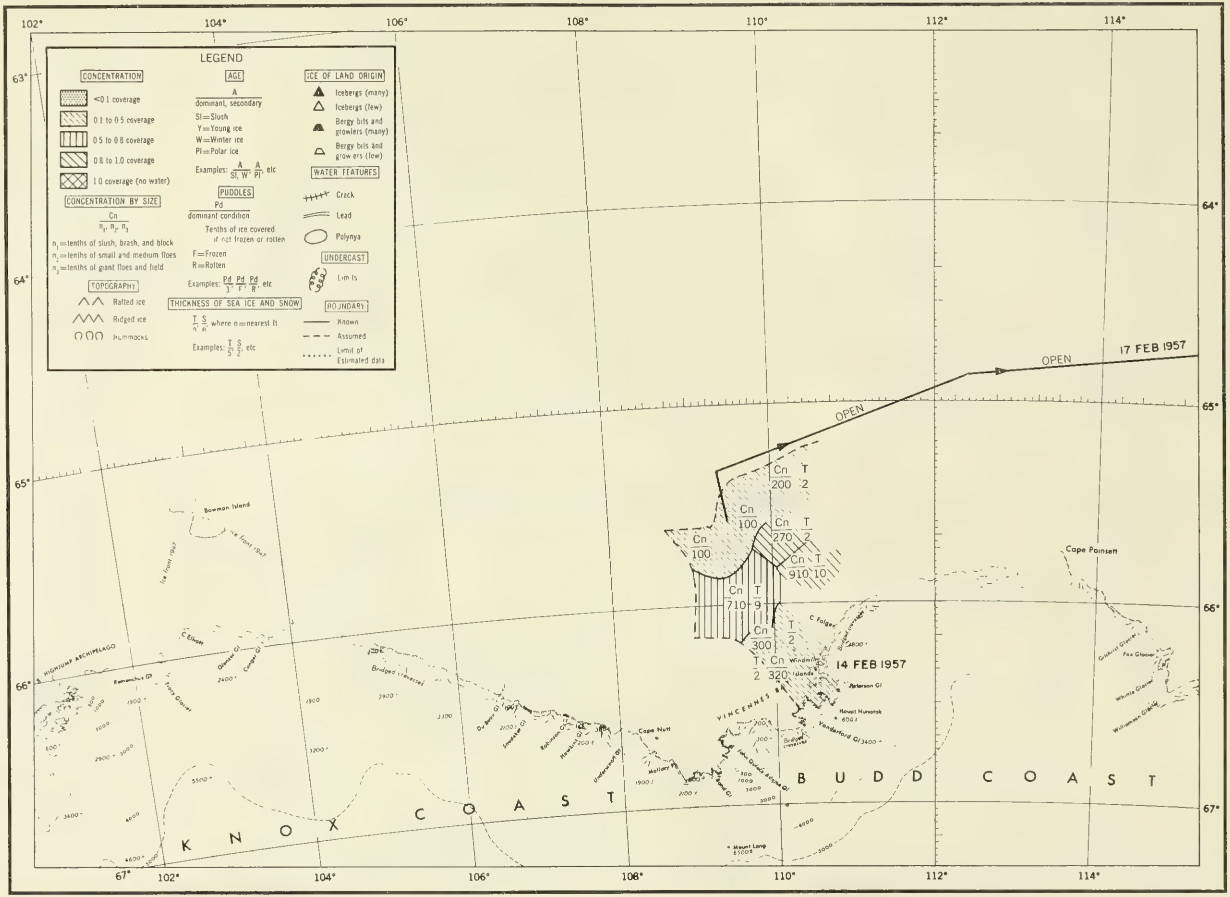


Fig. 27. Ice conditions, Knox and Budd Coasts - 14 February to 17 February 1957

concentration and three feet thickness was encountered until the open water adjacent to the Windmill Islands was reached.

On 15 February pack ice commenced moving in from the northeast, and by the 16th had almost completely filled the waters adjacent to Wilkes Station, making small boat operations difficult and time-consuming. Starting out early on the morning of 17 February 1957, the GLACIER led the cargo ships out through the pack ice without difficulty. The ice never offered serious resistance to the progress of the convoy and was at most only about eight-tenths in concentration, of which seven-tenths was block and brash with one-tenth small floes. It averaged three feet thick during the greater part of the passage. The change in ice conditions during the preceeding two weeks was very marked, indeed. Where the convoy had struggled through massed pack, it now sailed easily through more or less disintegrated ice. Open water was reached at about 65°37'S, 109°10'E and no more ice was seen on the northward passage, except a few blocks, which were passed through that night.

March - Departing Port Lyttelton, New Zealand on 2 March 1957 for Little America, McMurdo Sound, Moubray Bay, and then Australia, the NORTHWIND started the final venture of the 1956-1957 season into the Ross Sea. Unlike previous entries when the gamut of ice from isolated bergs to heavy pack ice was encountered, only one area presented any concentration of ice that might be termed difficult.

From Port Lyttelton to Little America no sea ice was encountered until arrival on 9 March at Little America where air temperatures of -17°F caused the formation of slush and pancake ice (Fig. 28). Leaving Kainan Bay on 10 March the NORTHWIND traversed generally open water with some patches of new ice. Enroute to McMurdo Sound the track was open with the exception of some bands of scattered ice. McMurdo was reached on 11 March and departure was made on 12 March for the Cape Hallett-Moubray Bay area. In contrast to the open water in and adjacent to McMurdo Sound (Fig. 23E), isolated belts and patches of scattered ice and bands of broken ice were encountered on the passage to Moubray Bay. In the Cape Hallett-Moubray Bay area on 13 March the heaviest ice of the trip was met. It was close ice, 4 to 6 feet thick, and under a moderate amount of pressure. On leaving Moubray Bay on the 14th the NORTHWIND passed through a few miles of broken and scattered ice which was the last ice seen enroute to Sydney, Australia except for a few, widely dispersed icebergs.

B. Bottom Sediments

1. General

The analyses of the 43 bottom samples obtained indicate that they are mainly of terrigenous origin and may be classified generally

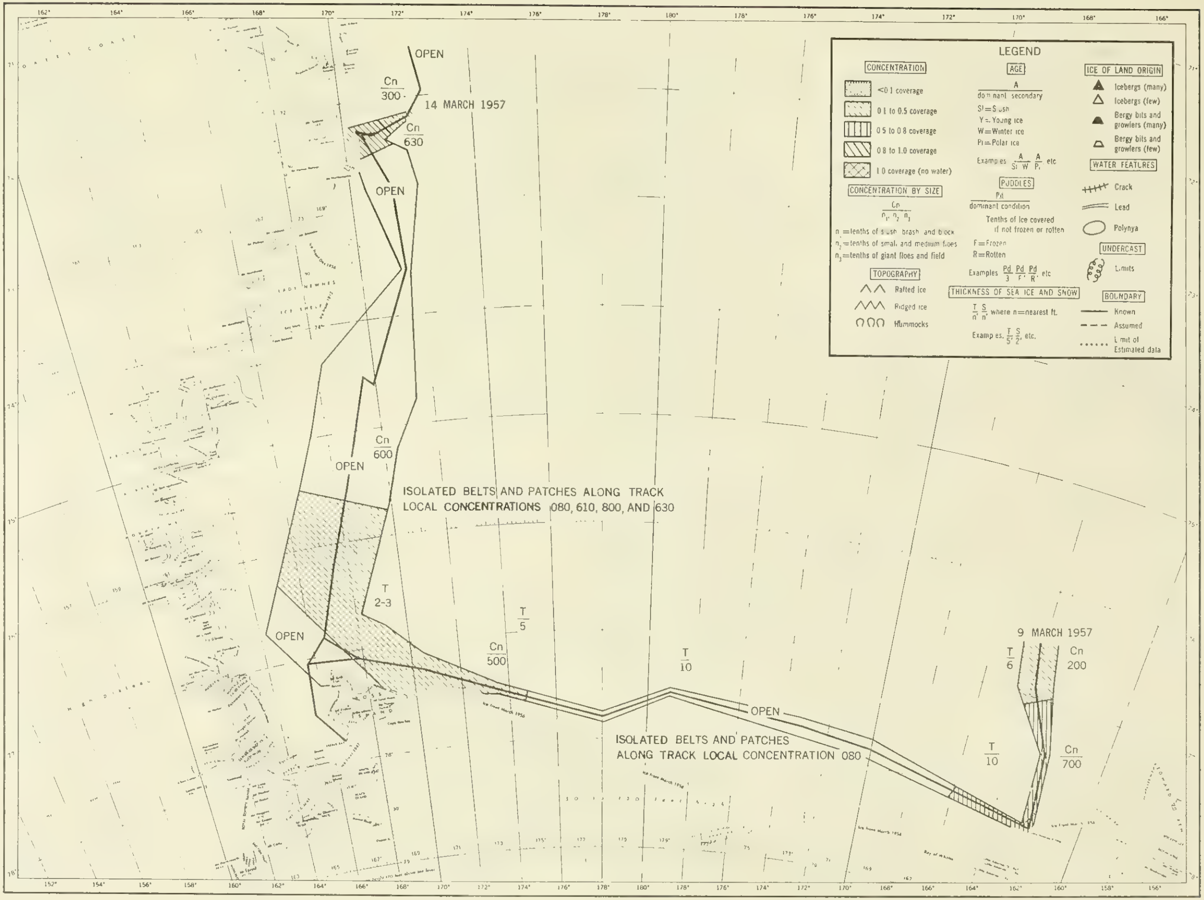


Fig. 28. Ice conditions, Ross Sea - 9 March to 14 March 1957

as marine glacial till. However, in a few cases, particularly from Vincennes Bay, the sediments were predominantly of biological origin. Very little chemical weathering of the shelf sediments is apparent and also very little sorting except for one locality in the Weddell Sea, and at Kainan Bay in the Ross Sea. Exceptions to this are those sediments composed primarily of organic remains. Identifications and percentages of the mineral and organic constituents of the sediments are rough approximations, since these were identified and estimated under a binocular microscope.

2. The Weddell Sea Area

The STATEN ISLAND obtained ten grab samples and three cores in the Weddell Sea. Of these, only one sample (orange-peel 1) was taken from the continental slope, at a depth of 1100 fathoms. This sample is not significantly different from the majority of other Weddell samples, except for its higher degree of sorting in the clay and silt sizes, and a high content of Radiolaria.

Except for one restricted area, all bottom samples exhibit poor sorting. The surface texture of the coarser fractions are glassy to frosted while both average sphericity and roundness are highly variable. The sand and gravel in these sediments are composed predominately of feldspar with either quartz or rock fragments of secondary importance. Common minor constituents are mica, garnet, hornblende, Radiolaria, and sponge spicules. The predominant grain size of these sediments, except for rock fragments to cobble size, range from fine sand to clay.

In an area centered approximately 77°15'S, 44°50'W, the bottom sediment analysis indicates the presence of a very well sorted, predominately quartzitic, medium-size sand. The grains possess high sphericity and roundness, and their surface textures range from frosted to polished. These sediments occur in water less than 200 fathoms deep, and exhibit every characteristic attributed to beach or dune sands.

Aliquot samples of the bottom sediments from the Weddell Sea area were collected and immediately frozen for the Scripps Institution of Oceanography, La Jolla, California. Final analysis by Scripps has not been completed at this time, but a preliminary bacterial analysis indicates that the sediments had very low or no viable aerobic bacteria, and had considerable numbers of viable sulfate reducing bacteria.

3. The Ross Sea Area

Sixteen bottom samples were obtained in the Ross Sea Area; nine grab samples and seven Phleger cores. Of these sixteen samples, eight were taken in McMurdo Sound, two in Kainan Bay, two in Moubray Bay, and four in the western sector of the Ross Sea. In addition one bottom photo, the first ever taken in the Antarctic, was obtained in McMurdo Sound (Annex B).

The McMurdo Sound samples were consistent in composition and character. They were generally gray to black in color, with the grains having dull, rough surface textures, and medium average sphericity and roundness. Medium to coarse sand sizes predominate in the coarse fractions, and the grains are chiefly composed of volcanic fragments with volcanic glass secondary. Appreciable quantities of feldspar, siliceous organic remains, and often shell fragments are also present. These sediments account for the hard bottom which causes difficulty in obtaining samples.

The character of the samples from Kainan Bay is entirely different. They are composed of soft, light olive gray to olive black plastic mud. The samples consist predominately of silt to clay-size fractions. The larger size grains have a dull, rough to pitted and polished surface texture, and medium average sphericity and roundness. Feldspar was the predominant mineral in samples from this area, with quartz secondary and appreciable amounts of rock fragments and mica present. GLACIER sample 3 indicates considerable percentages of volcanic glass, magnetite, and sponge spicules, but it may be contaminated from a previous sample taken with the same instrument in McMurdo Sound.

The longest core of the operation was taken in Kainan Bay by the ATKA; a 48-inch core was obtained using a piston corer (a modified Phleger), with a penetration to 53 inches. At the time of analysis this had been reduced in length to 41 inches due to compaction and dessication during transport. Particle size was predominantly in the silt and clay sizes throughout its entire length. The mineralogical content was also consistent at roughly 60% feldspar, 30% quartz, 10% rock fragments, and an appreciable quantity of mica. However, a slight change occurs in the 33- to 35-inch segment. A somewhat coarser fraction is introduced while the mica decreases to a trace, and a prominent trace of pyrite appears. Many granitic and gneissic pebbles and cobbles were also dredged up in Kainan Bay.

The two Moubray Bay samples obtained by the NORTHWIND differ considerably from each other both in size distribution and mineralogical content. Sample 1 taken in 205 fathoms consists of medium to coarse, black, volcanic sand with medium average sphericity and roundness. Its constituents were primarily of volcanic origin of which 50% was fragmental. The other sample, however, taken closer inshore in 111 fathoms, consists of grayish brown fine sand to silt, with a high organic content. The grains were of low average sphericity and roundness and the volcanic constituent was only 25%.

Four bottom samples were obtained by the GLACIER along approximately 175°E in the Ross Sea. These sediments are grayish olive to yellowish gray in color and primarily of biological origin, except for sample 5. This sample is a fine- to medium-size sand, consisting mostly of feldspar with quartz secondary and minor rock fragments, sponge spicules, and magnetite present.

4. Off the Coast of Wilkes Land

Twelve bottom samples were obtained in Vincennes Bay by the GLACIER; five grab samples and 7 Phleger cores. These range from granitic and quartzitic pebbles and cobbles to fine-grained, siliceous, biological remains. Diatoms and spicules compose about 95% of the coarser fraction of the fine-grained surface sediments in samples 15, 17, 18, and 22. These range in average particle size from clay to fine sand. At depths of 20 to 23 inches in sample 18, the organic remains decrease to a trace, and the coarse fraction of the sediment consists of about 65% feldspar, 30% quartz, and the remainder mica and pyroboles. The average grain size remains about the same throughout the length of the cores, while the average sphericity and roundness of the sand grains are medium, and the surface textures are dull and rough. The color of the sediments is olive gray.

Very little organic remains are present in the bottom samples obtained in water depths greater than 150 fathoms.. Their grain size is predominantly sand except for numerous pebbles. They range from light olive brown through gray in color. The grains are medium high to medium low average sphericity and roundness, and their surface textures are dull and rough. The mineral content of the sediments is predominantly feldspar, with a high percentage of quartz, and appreciable quantities of rock fragments and magnetite.

5. New Zealand Area

The USS ATKA obtained two cores in the New Zealand area while enroute to a logistics port. All the subsamples from both cores show a predominance of the clay-silt size fractions with a very small amount of sand and larger size particles. Surface texture is dull to rough throughout both, while average sphericity and roundness is medium in sample C-1 and slightly less than medium in sample C-5. Mineralogical analyses indicate a fairly high percentage (50%) of feldspar with lesser amounts of quartz and organic material.

C. Transparency and Water Color

Table 1 summarizes the transparency and water color data obtained on DEEP FREEZE II. Note that all transparency values in the Ross Sea fall between 20 and 22 meters with one exception. The observation in Kainan Bay produced the relatively low value of 7 meters in early January. McMurdo Sound values varied from 47 meters in early November to 5 meters in late December. The low values resulted from a heavy plankton crop which discolored the water and gave it a distinctly fishy taste and odor, even after passing through the ship's evaporators.

In the Weddell Sea Area, transparencies were greater at the higher latitudes. These latter observations were usually taken in the calm water of leads or polynyas within the pack ice.

Color variations ranged from 2% to 20% yellow, with two observations of 2%, eleven of 5%, six of 9%, six of 14%, and one of 20%. The bluest water (2% yellow) was found in the Weddell Sea, and the one observation of 20% yellow (greenish-blue water) was taken in late December in McMurdo Sound during a period of heavy plankton growth.

Table 1. Transparency and Water Color

Date	Position	Transparency (Meters)	Water Color (Percent yellow)
	Ross Sea		
8 Nov 1956	76°18'S, 174°56'E	20	14
9 Nov 1956	74°55'S, 174°53'E	22	14
9 Nov 1956	73°47'S, 175°08'E	20	14
10 Nov 1956	72°25'S, 174°10'E	22	5
18 Dec 1956	69°10'S, 177°55'E	38	-
	Kainan Bay		
1 Mar 1957	78°10'S, 167°26'E	7	14
	McMurdo Sound		
28 Oct 1956	77°36'S, 166°07'E	20	5
4 Nov 1956	77°40'S, 166°14'E	47	5
10 Nov 1956	77°49'S, 166°29'E	15	9
21 Dec 1956	77°39'S, 166°02'E	5	-
27 Dec 1956	77°43'S, 166°22'E	15	20
	Vincennes Bay		
8 Feb 1957	66°16'S, 110°33'E	8	-
14 Feb 1957	66°12'S, 109°56'E	12	5
	Weddell Sea		
9 Dec 1956	55°18'S, 61°12'W	-	2
10 Dec 1956	56°44'S, 55°32'W	7	5
10 Dec 1956	57°34'S, 53°10'W	6	-
11 Dec 1956	58°37'S, 44°49'W	9	9
11 Dec 1956	59°37'S, 27°25'W	9	9
12 Dec 1956	60°19'S, 44°23'W	7	14
13 Dec 1956	60°33'S, 37°20'W	6	9
15 Dec 1956	59°28'S, 25°09'W	14	2
17 Dec 1956	61°01'S, 15°39'W	15	5
18 Dec 1956	62°39'S, 14°21'W	-	2
20 Dec 1956	67°33'S, 11°41'W	9	14
27 Dec 1956	71°18'S, 13°32'W	20	5
28 Dec 1956	72°00'S, 15°14'W	15	5
16 Jan 1957	75°35'S, 57°48'W	18	9
16 Jan 1957	76°02'S, 56°30'W	21	5
20 Jan 1957	77°21'S, 44°30'W	17	5
13 Feb 1957	75°07'S, 25°55'W	16	5
14 Feb 1957	72°47'S, 21°07'W	10	9

D. Continuous Temperature Recordings

The GLACIER commenced recording sea surface and air temperatures while off Cuba, and continued such records almost without interruption until just before the pack was reached. The GLACIER again recorded surface water temperatures on the northern trip to New Zealand in November, and on the return trip in December. Recording of water temperature was also accomplished across the Pacific from New Zealand to Callao, Peru and north to Panama and Boston. An interesting trace was obtained when the GLACIER crossed the Gulf Stream and again when the continental slope of North America was reached.

Analysis of the GLACIER's continuous temperature records show that in the Caribbean and tropical areas, the air temperatures five feet above the water surface averaged one to two degrees lower than the water temperatures. This probably resulted from cooling by evaporation. Simultaneous welldeck temperatures were slightly higher than either the water or the air immediately above the water, and on occasion they were considerably higher.

South of about 40°S, the air immediately above the water averaged slightly warmer than the water itself, and the welldeck temperatures were the coolest.

Because of installation failure and early encounter with the pack-ice, the sea water element was not used aboard the STATEN ISLAND until moored along the Filchner Shelf in the Weddell Sea. Water temperatures remained relatively steady (between -1.0° and -2.0°C) as the element was actually under newly formed ice. Air temperatures were variable, but were generally well below 0°C. After departing from pack ice areas enroute northward, the sea element recorded temperatures varying around 0°C, and gradually reaching around 5.0°C. A three-degree rise (6.0° to 9.0°C) within two hours steaming (about 30 nautical miles) marked the Antarctic Convergence. The position and description of the convergence is described under "Bathythermograph Observations" in this report.

The NORTHWIND began taking continuous records of surface and air temperature upon departure from Hawaii, and except for periods of mechanical breakdown of equipment or traverse of ice-covered areas records were made during two passages from New Zealand to the Antarctic and during operations in the Ross Sea area. Data collected agreed in general with those of the GLACIER for the Antarctic, but damage to the sea water resistance thermometer from contact with ice render an absolute analysis of the data impractical.

E. Deep Scattering Layer

The Deep Scattering Layer (DSL) causes a premature and partial reflection of the intermittent sound signals emitted by an echo-sounder. This results in a trace at shallower depths on the echograms in addition to the normal bottom trace. The exact cause of this "phantom bottom" has not been fully determined, but as it migrates toward the surface during darkness, and away from the surface during brightness, a biological origin is implied.

Echograms from an AN/UQN-1 series echo-sounder were obtained aboard the USS GLACIER during Operation DEEP FREEZE II. Notes on the daily occurrence of the DSL were taken by the Hydrographic Office Representative aboard the GLACIER, and the data obtained from the Pacific and Antarctic areas were subsequently analyzed in the U. S. Navy Hydrographic Office.

During the 63 days of steaming, definite evidence of a daytime development of the DSL appeared on the echograms south of about 64°30'S. The layer was observed only as an audible signal on at least 12 other days, and was heard along one track as far south as about 65°30'S. The layer traces usually exhibited typical negative phototaxis movement, i.e., movement away from light. Variations in this cycle have been described and discussed in the DEEP FREEZE I Report. Prevailing daytime depth of the layer, both on the echograms and by audible signal, the occurrence of double layers, and other pertinent notes are shown in Figure 28.

The Antarctic Convergence was crossed once in October, by the GLACIER while the DSL was being recorded, and no change in depth was evident. In February, south of Tasmania, rough weather during the crossing of the convergence interfered with the recording. However, south of the convergence the DSL was recorded at a depth of 200 fathoms, and 250 fathoms to the north for a period of two hours.

Data on the positions of disappearance and reappearance of the layer as recorded on the echograms of the GLACIER are shown below:

Position of Disappearance and Reappearance of DSL

Date	Disappearance	Approximate Location of Antarctic Convergence	Reappearance	Approximate Location of Antarctic Convergence
13 Oct 56	62°21'S	2°21' to north		
14 Nov 56			58°30'S	3°30' to south
14 Dec 56	61°20'S	1°10' to south		
20 Feb 57			61°20'S	6°20' to north

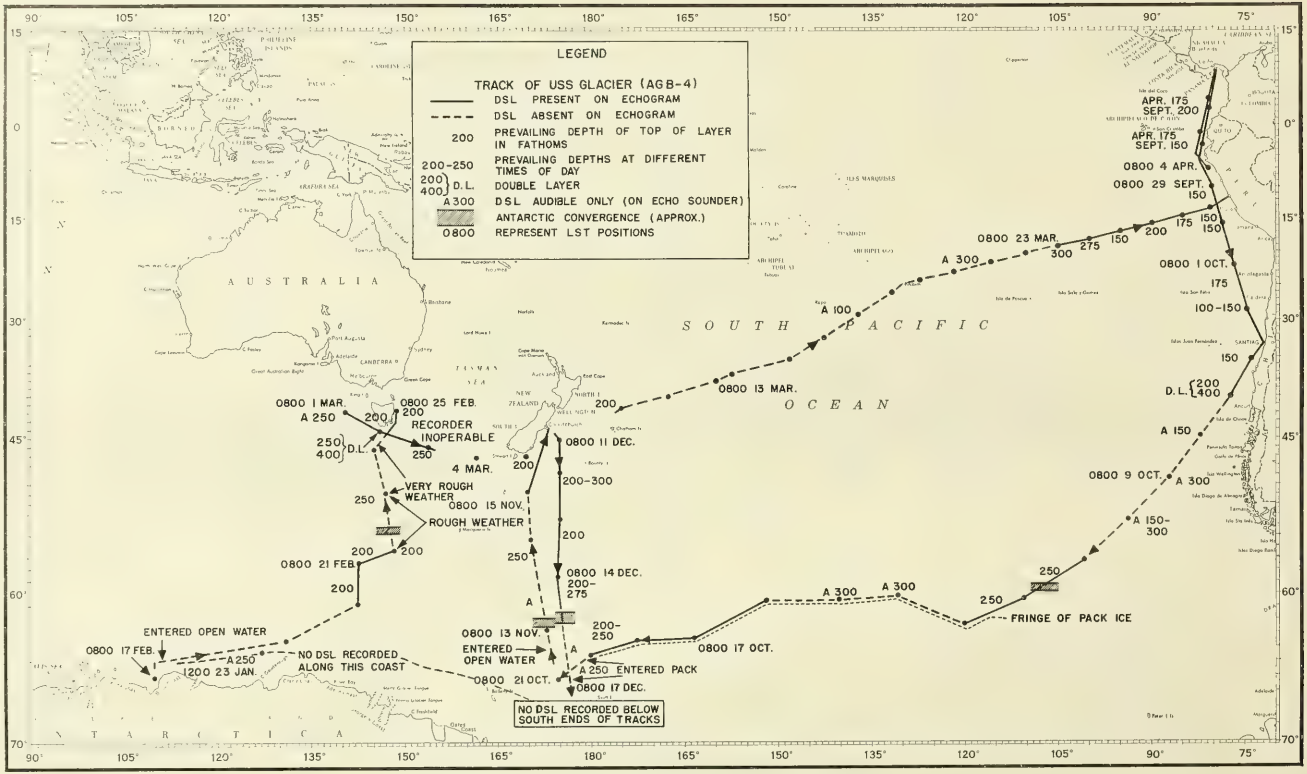


Fig. 29. Deep scattering layer (DSL)

In the report on DEEP FREEZE I, DSL observations of the French Antarctic Expedition of 1948-1949 were discussed. During the French expedition of 1949-1950 the COMMANDANT CHARCOT passed through the ice pack into open water to the south, where the DSL was recorded as far south as 66°S. Shoal water prevented further observations.

As usual, ice interfered with the operation of the echo-sounder when the GLACIER was steaming through the pack. The DSL was never recorded and was only rarely and weakly heard while the ship was in the pack, although special checks were made in open leads.

Once again the complete absence or poor development of the layer was noted during the ship's passage through the central South Pacific Ocean. This absence was especially lengthy, extending on the GLACIER's track from about 41°S, 171°W to about 20°S, 107°W.

F. Biological Collections

Cursory field examination of the collected material indicates an abundant plankton complex. The benthonic population on the shelf areas was extremely rich in invertebrates and fish, both in amount and variety of forms. These include asteroids, ophiuroids, holothurians, echinoids, crinoids, bryozoa, hydroids, alcyonaria, keratose and silicious porifera, isopods, amphipods, decapods, annelids, brachiopods, mollusca and many other groups. Fish were usually taken by means of the Blake trawl.

Whale and other marine animal observations were recorded where possible and these data are on file in the Hydrographic Office. Killer whales were observed in the southernmost extremity of the Weddell Sea among other locations. About thirty whales (probably finback and sei) were observed in Kainan Bay on 7 January 1957. Seals were encountered in all areas, and penguins were observed in all previously reported locations. An Emperor penguin rookery, observed in Gould Bay in the Filchner Ice Shelf, is believed to have been previously unreported.

APPENDIX A

OCEANOGRAPHIC STATION DATA

Explanation of Data

GENERAL

Each of the items appearing on the data pages is explained below. The vertical arrows shown in some of the column headings indicate the location of decimal points. The presence of an asterisk to the left of the data indicates that data as doubtful; hence, such data were not used in the construction of the curve from which the interpolated values (standard depth values) were derived. Observed values which were obviously false were omitted.

SURFACE OBSERVATIONS

1. Cruise Number - This number is arbitrarily assigned. It identifies the cruise and provides a means of sorting from the IBM file all cards pertaining to that particular cruise. For Operation DEEP FREEZE II, 1956-1957, cruise number 00560 was assigned to the USS ATKA (AGB-3), cruise number 00561 to the USS STATEN ISLAND (AGB-5), cruise number 00562 to the USCGC NORTHWIND (WAGB-282), and cruise number 00563 to the USS GLACIER (AGB-4).

2. Station Number - Stations are numbered consecutively, starting with one, at the beginning of each cruise. Therefore, for a complete identification of a particular station, both cruise and station number are necessary.

3. Date - Month and day are given in Arabic numerals. The last three figures of the year are indicated. The hour is Greenwich Mean Time and is that hour nearest to the start of the first cast.

4. Latitude and Longitude - The position of the station is given in degrees and minutes.

5. Sonic Depth - Sonic Depth is the uncorrected sounding for the station, recorded in meters.

6. Maximum Sample Depth - The maximum depth from which a water sample was obtained at the station is given to the nearest 100 meters.

7. Wind - Wind speed is given in meters per second. Direction from which the wind blows is coded in degrees true to the nearest ten degrees. The last zero is omitted. North is 36 on this scale and calm is 0. See Tables Defining Code Sumbols - I, Compass Direction Conversion Tables for Wind, Sea, and Swell Directions.

8. Anemometer Height - The height of the anemometer above the waterline is given in meters.

9. Barometric Pressure - Barometric pressure is coded in millibars, neglecting the 900 or 1000. Thus, 996 millibars is coded as 96, and 1008 millibars is coded as 08.

10. Air Temperature - Dry bulb and wet bulb temperatures are entered to the nearest tenth of a degree (centigrade). A negative temperature is coded by dropping the minus sign and adding 50; thus -10° is coded as 60.

11. Humidity - The percent of humidity is coded directly, 100 percent being coded as 99.

12. Weather - Weather is coded as indicated under Tables Defining Code Symbols - II, Numerical Weather Codes - Present Weather.

13. Cloud - Cloud type and amount are coded as indicated under Tables Defining Code Symbols - III, Cloud Type and IV, Cloud Amount.

14. Sea - Sea direction and amount are coded as indicated under Tables Defining Code Symbols - V. Sea Amount.

15. Swell - Swell direction and amount are coded as indicated under Tables Defining Code Symbols - VI, Swell Amount.

16. Visibility - Visibility is coded as indicated under Tables Defining Code Symbols - VII, Visibility.

17. Color - Water color is coded as percent yellow.

18. Transparency - Water transparency is coded as the depth of visual disappearance of a white Secchi disc, recorded to the nearest meter.

SUBSURFACE OBSERVATIONS

1. Sample Depth - Observed (actual) depth of each sample is given in meters. Interpolated values at standard depths are also given. The standard depths, in meters, are: 0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 2000, 2500, 3000, and hence every 1000 meters.

2. Temperature - The centigrade temperature is given in degrees and hundredths.

3. Salinity - Salinity is given in parts per thousand (by weight) to two decimal places.

4. Sigma-t - To convert to density divide by 1000 and add 1, thus, a sigma-t value of 22.35 converts to a density of 1.02235.

5. Delta-D - The values in the columns are the anomalies of dynamic depths from the surface to each level in dynamic meters. Each entry is the cumulative sum of the anomalies of dynamic depth of the layer above. These values have been computed for the Standard depths only, and serve to identify computed points.

6. Dissolved Oxygen - These values are given in milliliters per liter to two decimal places. Because of pollution in one of the analyzing reagents, the oxygen values presented are considered doubtful in the absolute sense, but satisfactory from a relative viewpoint.

7. Sound Velocity - Sound velocity is given in feet per second to one decimal place, corrected for pressure at each depth.

TABLES DEFINING CODE SYMBOLS

I. Compass Direction Conversion Table for Wind, Sea, and Swell Directions

Code	Direction
00	Calm
01	5° to 14°
02	15° to 24° NNE
03	25° to 34°
04	35° to 44°
05	45° to 54° NE
06	55° to 64°
07	65° to 74° ENE
08	75° to 84°
09	85° to 94° E
10	95° to 104°
11	105° to 114° ESE
12	115° to 124°
13	125° to 134°
14	135° to 144° SE
15	145° to 154°
16	155° to 164° SSE
17	165° to 174°
18	175° to 184° S
19	185° to 194°
20	195° to 204° SSW
21	204° to 214°
22	215° to 224°
23	225° to 234° SW
24	235° to 244°
25	245° to 254° WSW
26	255° to 264°
27	265° to 274° W
28	275° to 284°
29	285° to 294° WNW
30	295° to 304°
31	305° to 314°
32	315° to 324° NW
33	325° to 334°
34	335° to 344° NNW
35	345° to 354°
36	355° to 4° N

TABLE II NUMERICAL WEATHER CODES—PRESENT WEATHER

00 Cloud development NOT observed or NOT observable during past hour.	**01** Clouds generally dissolving or becoming less developed during past hour.	**02** State of sky on the whole unchanged during past hour	**03** Clouds generally forming or developing during past hour.	**04** Visibility reduced by smoke	**05** Haze	**06** Widespread dust in suspension in the air, NOT raised by wind, at time of observation.	**07** Dust or sand raised by wind, at time of observation.	**08** Well developed dust devil(s) within past hour.	**09** Duststorm or sand storm within sight of or at station during past hour.
10 Light fog	**11** Patches of shallow fog at station, NOT deeper than 6 feet on land	**12** More or less continuous shallow fog at station, NOT deeper than 6 feet on land	**13** Lightning visible, no thunder heard	**14** Precipitation within sight, but NOT reaching the ground	**15** Precipitation within sight, reaching the ground, but distant from station	**16** Precipitation within sight, reaching the ground, near to but NOT at station.	**17** Thunder heard, but no precipitation at the station	**18** Squall(s) within sight during past hour.	**19** Funnel cloud(s) with in sight during past hour
20 Drizzle (NOT freezing andNOTfalling as showers) during past hour, but NOT at time of ob.	**21** Rain (NOT freezing andNOTfalling as showers) during past hour, but NOT at time of ob	**22** Snow (NOT falling as showers) during past hour, but NOT at time of observation.	**23** Rain and snow (NOT falling as showers) during past hour, but NOT at time of observation.	**24** Freezing drizzle or freezing rain (NOT falling as showers) during past hour, but NOT at time of observation.	**25** Showers of rain during past hour, but NOT at time of observation.	**26** Showers of snow, or of rain and snow, during past hour, but NOT at time of observation.	**27** Showers of hail, or of hail and rain, during past hour, but NOT at time of observation.	**28** Fog during past hour, but NOT at time of observation.	**29** Thunderstorm (with or without precipitation) during past hour, but NOT at time of observation.
30 Slight or moderate duststorm or sandstorm has decreased during past hour.	**31** Slight or moderate duststorm or sandstorm no appreciable change during past hour.	**32** Slight or moderate duststorm or sandstorm has increased during past hour.	**33** Severe duststorm or sandstorm, has decreased during past hour.	**34** Severe duststorm or sandstorm, no appreciable change during past hour	**35** Severe duststorm or sandstorm, has increased during past hour.	**36** Slight or moderate drifting snow, generally low.	**37** Heavy drifting snow, generally low.	**38** Slight or moderate drifting snow, generally high.	**39** Heavy drifting snow, generally high.
40 Fog at distance at time of observation, but NOT at station during past hour.	**41** Fog in patches.	**42** Fog, sky discernible, has become thinner during past hour.	**43** Fog, sky NOT discernible, has become thinner during past hour.	**44** Fog, sky discernible, no appreciable change during past hour.	**45** Fog, sky NOT discernible no appreciable change during past hour.	**46** Fog, sky discernible, has begun or become thicker during past hour.	**47** Fog, sky NOT discernible, has begun or become thicker during past hour.	**48** Fog, depositing rime, sky discernible.	**49** Fog, depositing rime, sky not discernible.
50 Intermittent drizzle (NOT freezing) slight at time of observation.	**51** Continuous drizzle (NOT freezing) slight at time of observation.	**52** Intermittent drizzle (NOT freezing) moderate at time of oh.	**53** Continuous drizzle (NOT freezing), moderate at time of ob.	**54** Intermittent drizzle (NOT freezing), thick at time of observation.	**55** Continuous drizzle (NOT freezing), thick at time of observation.	**56** Slight freezing drizzle.	**57** Moderate or thick freezing drizzle.	**58** Drizzle and rain, slight.	**59** Drizzle and rain, moderate or heavy.
60 Intermittent rain (NOT freezing), slight at time of observation.	**61** Continuous rain (NOT freezing), slight at time of observation.	**62** Intermittent rain (NOT freezing), moderate at time of ob.	**63** Continuous rain (NOT freezing), moderate at time of observation.	**64** Intermittent rain (NOT freezing), heavy at time of observation.	**65** Continuous rain (NOT freezing), heavy at time of observation.	**66** Slight freezing rain.	**67** Moderate or heavy freezing rain.	**68** Rain or drizzle and snow, slight.	**69** Rain or drizzle and snow, moderate or heavy.
70 Intermittent fall of snowflakes, slight at time of observation.	**71** Continuous fall of snowflakes, slight at time of observation.	**72** Intermittent fall of snowflakes, moderate at time of observation.	**73** Continuous fall of snowflakes, moderate at time of observation.	**74** Intermittent fall of snowflakes, heavy at time of observation.	**75** Continuous fall of snowflakes, heavy at time of observation.	**76** Ice needles (with or without fog).	**77** Granular snow (with or without fog).	**78** Isolated starlike snow crystals (with or without fog).	**79** Ice pellets (sleet, U S definition)
80 Slight rain shower(s).	**81** Moderate or heavy rain shower(s).	**82** Violent rain shower(s).	**83** Slight shower(s) of rain and snow mixed.	**84** Moderate or heavy shower(s) of rain and snow mixed.	**85** Slight snow shower(s).	**86** Moderate or heavy snow shower(s).	**87** Slight shower(s) of soft or small hail with or without rain or rain and snow mixed.	**88** Moderate or heavy shower(s) of soft or small hail with or without rain or rain and snow mixed.	**89** Slight shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder
90 Moderate or heavy shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder.	**91** Slight rain at time of ob.; thunderstorm during past hour, but NOT at time of observation.	**92** Moderate or heavy rain at time of ob.; thunderstorm during past hour, but NOT at time of observation.	**93** Slight snow or rain and snow mixed or hail at time of observation.; thunderstorm during past hour, but not at time of observations.	**94** Mod. or heavy snow, or rain and snow mixed or hail at time of ob.; thunderstorm during past hour, but NOT at time of observation.	**95** Slight or mod. thunderstorm without hail, but with rain and/or snow at time of observation.	**96** Slight or moderate thunderstorm, with hail at time of observation.	**97** Heavy thunderstorm, without hail, but with rain and/or snow at time of observation.	**98** Thunderstorm combined with duststorm or sandstorm at time of observation.	**99** Heavy thunderstorm with hail at time of observation.

III. Cloud Type

Code	
0	Stratus or Fractostratus
1	Cirrus
2	Cirrostratus
3	Cirrocumulus
4	Altocumulus
5	Altostratus
6	Stratuscumulus
7	Nimbostratus
8	Cumulus or Fractocumulus
9	Cumulonimbus

IV. Cloud Amount

Code	
0	No clouds
1	Less than 1/10 or 1/10
2	2/10 and 3/10
3	4/10
4	5/10
5	6/10
6	7/10 and 8/10
7	9/10 and 9/10 plus
8	10/10
9	Sky obscured

V. Sea Amount

Code	Approximate Height (feet)	Description
0	------	Calm
1	Less than 1	Smooth
2	1 to 3	Slight
3	3 to 5	Moderate
4	5 to 8	Rough
5	8 to 12	Very Rough
6	12 to 20	High
7	20 to 40	Very high
8	40 and over	Mountainous
9	------	Very rough confused sea

VI. Swell Amount

Code	Approximate Height (feet)	Description		Approximate Length (feet)
0	------	No swell		------
1	1 to 6	Low swell	Short	0 to 600
			Average	
2			Long	Above 600
3	6 to 12	Moderate	Short	0 to 300
4			Average	300 to 600
5			Long	Above 600
6	Greater than 12	High	Short	0 to 300
7			Average	300 to 600
8			Long	Above 600
9	------	Confused		------

VII. Visibility

Code		
0	Dense Fog	50 yards
1	Thick Fog	200 yards
2	Fog	400 yards
3	Moderate Fog	1000 yards
4	Thin Fog or Mist	1 mile
5	Visibility poor	2 miles
6	Visibility moderate	5 miles
7	Visibility good	10 miles
8	Visibility very good	30 miles
9	Visibility excellent	Over 30 miles

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00560	0001	01	03	957	02	78	10S	167	26W	0640	05

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	17	24	72	04 4	02 2	68	02	4	3		1		1	7	14	07

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 05	33 95	27 32	0 000		4721 7
0000	-01 05	33 95	27 32		*8 41	4721 7
0009	-01 05	34 01	27 37		*8 42	4722 5
0010	-01 04	34 01	27 37	0 007		4722 7
0020	-00 92	34 01	27 37	0 015		4725 2
0025	-00 87	34 01	27 37		*8 47	4726 3
0030	-00 82	34 02	27 37	0 022		4727 4
0050	-00 70	34 05	27 39	0 036		4730 6
0050	-00 70	34 05	27 39		*8 56	4730 6
0075	-00 79	34 07	27 41	0 053		4730 8
0075	-00 79	34 07	27 41		*8 56	4730 8
0100	-01 00	34 18	27 51	0 068		4729 4
0100	-01 00	34 18	27 51		*8 25	4729 4
0150	-01 72	34 33	27 65	0 094		4721 7
0150	-01 72	34 33	27 65		*7 05	4721 7
0200	-02 03	34 37	27 69	0 115		4720 0
0200	-02 03	*31 27	*25 18		*6 48	*4706 4
0250	-01 88	34 39	27 71	0 134		4725 4
0300	-01 80	34 41	27 72	0 153		4729 7
0300	-01 80	34 41	27 72		*6 43	4729 7
0400	-01 83	34 42	27 73	0 189		4735 3
0400	-01 83	34 42	27 73		*6 49	4735 3
0500	-01 81					
0500	-01 81	*33 29	*26 81		*6 31	*4736 5

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00560	0002	02	10	957	02	77	49S	166	29E	0527	05

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	10	24	98	67 8	68 3	85	00		0	00	0	00	0	7	09	15

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 66					
0000	-01 66				*8 21	
0010	-01 73					
0010	-01 73				*8 26	
0020	-01 74					
0020	-01 74				*8 22	
0030	-01 43					
0030	-01 43				*8 07	
0050	-01 20					
0050	-01 20				*7 62	
0075	-01 25					
0075	-01 25				*7 13	
0100	-01 34					
0100	-01 34				*6 90	
0150	-01 87					
0150	-01 87				*6 47	
0200	-01 92					
0200	-01 92				*6 37	
0250	-01 91					
0300	-01 90					
0300	-01 90				*6 44	
0400	-01 87					
0400	-01 87				*6 41	
0500	-01 91					
0500	-01 91				*6 38	

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0001	12	09	956	16	55	18S	061	12W	4023	12

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	32	22	08	04 6	04 1	93	50	0	8	27	3	26	1	7	02	

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	05 06	34 07	26 95	0 000		4811 2
0000	05 06	34 07	26 95		*7 34	4811 2
0010	05 07	34 06	26 94	0 011		4811 9
0015	05 07	34 06	26 94		*7 24	4812 2
0020	05 02	34 06	26 95	0 022		4811 8
0030	04 95	34 07	26 97	0 033		4811 5
0038	04 92	34 08	26 98		*7 23	4811 6
0050	04 92	34 13	27 02	0 055		4812 5
0056	04 92	34 14	27 03		*7 30	4812 9
0075	04 78	34 14	27 04	0 081		4812 1
0076	04 77	34 14	27 04		*7 20	4812 1
0100	04 61	34 15	27 07	0 107		4811 3
0150	04 30	34 18	27 13	0 156		4810 2
0151		34 18			*7 08	
0200	04 02	34 22	27 19	0 203		4809 5
0226	03 89	34 23	27 21		*6 91	4809 2
0250	03 78	34 23	27 22	0 248		4809 1
0300	03 58	34 23	27 24	0 291		4809 3
0374	03 32	34 22	27 26		*6 59	4810 0
0400	03 25	34 21	27 25	0 377		4810 5
0500	03 01	34 18	27 25	0 463		4813 0
0525	*02 69	34 18	*27 28		*6 44	*4809 9
0600	02 84	34 18	27 27	0 548		4816 5
0676	02 76	34 17	27 27		*5 64	4819 8
0800	02 75	34 35	27 41	0 706		4827 8
0916	02 75	34 47	27 51		*4 47	4835 2
1000	02 70	34 52	27 55	0 839		4839 7
1194	02 48	34 52	27 57		*4 03	4848 1

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0002	12	10	956	03	56	01S	058	23W	3658	09

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	25	22	03	06 0	04 9	84	50	0	8	25	3	29	4	6		

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/₀₀	σ_t	$\Sigma\Delta D$	O_2ml/l	V_f
0000	05 50	33 89	26 76	0 000		4816 4
0000	05 50	33 89	26 76		*7 47	4816 4
0010	05 50	33 93	26 79	0 013		4817 1
0020	05 50	33 96	26 81	0 025		4817 8
0030	05 49	33 98	26 83	0 038		4818 4
0043	05 49	34 01	26 86		*7 13	4819 3
0050	05 33	34 02	26 88	0 062		4817 6
0075	04 87	34 04	26 95	0 091		4812 9
0087	04 70	34 05	26 98		*6 96	4811 4
0100	04 68	34 07	27 00	0 118		4812 0
0150	04 60	34 12	27 04	0 171		4814 1
0176	04 56	34 14	27 07		*6 89	4815 1
0200	04 55	34 15	27 07	0 223		4816 5
0250	04 49	34 18	27 10	0 273		4818 7
0265	04 46	34 18	27 11		*6 80	4819 2
0300	04 34	34 18	27 12	0 322		4819 6
0354	04 15	34 19	27 15		*6 77	4820 3
0400	04 00	34 20	27 17	0 418		4821 0
0444		34 20			*6 68	
0500	03 69	34 20	27 20	0 511		4822 6
0534	03 59	34 20	27 21		*6 49	4823 2
0600	03 36	34 20	27 24	0 601		4823 9
0716	03 06	34 21	27 27		*5 79	4826 6
0800	02 92	34 23	27 30	0 773		4829 7
0900	02 85	34 27	27 34		*5 23	4834 8

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0003	12	10	956	12	56	44S	055	32W	4297	08

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	27	22	98	05 6	04 7	88	C2	0	8	27	3	27	4	6	05	07

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C ↓	S °/.. ↓	σ_t ↓	ΣΔD ↓	O_2ml/l ↓	V_t ↓
0000	04 74	34 08	27 00	0 000		4806 9
0000	04 74	34 08	27 00		*7 37	4806 9
0010	04 74	34 09	27 01	0 011		4807 5
0020	04 74	34 11	27 02	0 021		4808 2
0030	04 74	34 12	27 03	0 032		4808 8
0042	04 74	34 13	27 04		*7 35	4809 6
0050	04 63	34 14	27 06	0 052		4808 6
0075	04 30	34 16	27 11	0 077		4805 6
0084	04 19	34 16	27 12		*6 76	4804 7
0100	03 96	34 15	27 14	0 101		4802 4
0150	03 42	34 13	27 17	0 148		4797 7
0166	03 30	34 13	27 19		*6 76	4797 0
0200	03 26	34 15	27 21	0 193		4798 5
0249	03 13	34 17	27 23		*6 23	4799 7
0250	03 12	34 17	27 23	0 236		4799 6
0300	02 88	34 18	27 26	0 279		4799 2
0332	02 75	34 20	27 29		*5 99	4799 3
0400	02 64	34 25	27 34	0 359		4802 0
0414		34 26				
0497	02 53	34 27	27 37		*5 26	4806 3
0500	02 53	34 27	27 37	0 434		4806 5
0600	02 51	34 34	27 42	0 507		4812 4
0671	02 50	34 38	27 46		*4 76	4816 7
0800		34 44				
0824	*02 64	34 45	*27 50		*4 15	*4828 1

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0004	12	10	956	23	57	34S	053	10W	7874	20

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
07	25	22	96	02 0	01 1	86	02	0	8	25	3	31	1	6		06

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	01 26	33 91	27 17	0 000		4756 7
0000	01 26	33 91	27 17		*8 22	4756 7
0010	01 23	33 91	27 18	0 009		4756 9
0020	01 18	33 91	27 18	0 018		4756 7
0030	01 10	33 92	27 19	0 027		4756 2
0048	00 92	33 92	27 20		*8 08	4754 5
0050	00 88	33 93	27 22	0 044		4754 1
0075	00 40	33 99	27 29	0 065		4748 6
0097	00 09	34 04	27 35		*8 00	4745 5
0100	00 07	34 04	27 35	0 084		4745 3
0150	00 07	34 08	27 38	0 120		4748 5
0194	00 05	34 14	27 43		*6 57	4751 0
0200	00 13	34 15	27 43	0 154		4752 7
0250	00 73	34 25	27 48	0 186		4765 1
0291	01 17	34 33	27 52		*5 18	4774 5
0300	01 28	34 35	27 53	0 215		4776 7
0389	02 06	34 50	27 59		*4 35	4794 1
0400	02 06	34 51	27 60	0 270		4794 8
0488		34 57			*4 19	
0500	02 06	34 58	27 65	0 320		4801 0
0587	02 06	34 61	27 68		*4 16	4806 3
0600	02 06	34 61	27 68	0 366		4807 1
0788	02 03	34 64	27 70		*4 17	4818 0
0800	02 02	34 64	27 70	0 455		4818 5
0988	01 86	34 64	27 72		*4 23	4827 4
1000	01 85	34 64	27 72	0 542		4828 0
1200	01 72	34 68	27 76	0 624		4838 1
1487	01 53	34 71	27 80		*4 42	4852 5
1500	01 52	34 71	27 80	0 738		4853 1
1987	01 16	34 72	27 83		*4 60	4876 8

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0005	12	11	956	11	58	37S	049	49W	6069	10

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
07	02	22	96	00 6	50 3	85	02	0	8	23	2	04	1	6	09	09

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	00 76	34 14	27 39	0 000		4750 2
0000	00 76	34 14	27 39		*7 94	4750 2
0010	00 76	34 16	27 41	0 007		4750 9
0020	00 76	34 17	27 42	0 014		4751 6
0030	00 76	34 19	27 43	0 020		4752 2
0048	00 76	34 21	27 45		*7 94	4753 4
0050	00 74	34 21	27 45	0 033		4753 2
0075	00 50	34 23	27 48	0 049		4751 2
0096	00 34	34 25	27 50		*6 76	4750 1
0100	00 33	34 26	27 51	0 064		4750 2
0150	00 19	34 34	27 58	0 091		4751 4
0194	00 13	34 40	27 64		*6 51	4753 4
0200	00 13	34 41	27 64	0 115		4753 8
0250	00 16	34 47	27 69	0 137		4757 5
0292	00 18	34 50	27 71		*6 28	4760 4
0300	00 21	34 50	27 71	0 157		4761 3
0392	00 54	34 53	27 72		*5 63	4771 9
0400	00 57	34 53	27 72	0 196		4772 9
0492	*00 36	34 56	*27 75		*5 22	*4775 3
0500	00 89	34 57	27 73	0 235		4783 8
0591	01 06	34 62	27 76		*4 87	4791 9
0600	01 06	34 62	27 76	0 273		4792 5
0791	01 06	34 65	27 78		*4 77	4803 9
0800	01 05	34 65	27 78	0 343		4804 3
0990	00 59	34 67	27 83		*5 00	4808 8

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0006	12	11	956	23	59	37S	047	25W	3931	18

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	06	22	94	00 7	50 8	73	02	0	8	05	2	03	1	7	09	09

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	00 34	34 26	27 51	0 000		4744 4
0000	00 34	34 26	27 51		*8 21	4744 4
0010	00 32	34 27	27 52	0 006		4744 8
0020	00 30	34 29	27 54	0 011		4745 1
0030	00 28	34 31	27 56	0 017		4745 5
0045	00 26	34 34	27 58		*7 60	4746 2
0050	00 25	34 36	27 60	0 027		4746 5
0075	00 25	34 43	27 65	0 039		4748 3
0089	*00 71	34 46	*27 65		*5 62	*4756 1
0100	00 24	34 46	27 68	0 050		4749 7
0150	00 23	34 47	27 69	0 071		4752 6
0179	00 22	34 48	27 70		*5 94	4754 2
0200	00 37	34 51	27 71	0 091		4757 8
0250	00 65	34 56	27 74	0 110		4765 3
0269	00 73	34 58	27 75		*5 29	4767 7
0300	00 83	34 59	27 75	0 129		4771 1
0359	00 93	34 61	27 76		*5 01	4776 1
0400	00 80	34 64	27 79	0 163		4776 8
0450	*00 34	34 66	*27 83		*4 83	*4772 9
0500	00 57	34 68	27 84	0 193		4779 4
0541	00 51	34 69	27 85		*5 20	4781 0
0600	00 49	34 70	27 86	0 220		4784 3
0723	00 46	34 71	27 87		*5 20	4791 2
0800	00 55	34 72	27 87	0 271		4797 2
0908	00 79	34 73	27 86		*4 98	4807 2
*1092	00 54	34 75	27 89		*5 00	*4814 5
*1370	00 28	34 75	27 91		*5 13	*4827 1
*1652	00 14	34 76	27 93		*5 29	*4841 8
*1844	00 09	34 75	27 92		*5 22	*4852 4

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0007	12	12	956	12	60	19S	044	23W	5066	09

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
11	09	22	82	51 8	52 1	95	73		9	09	3	34	2	3	14	07

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-00 38	34 13	27 44	0 000		4732 9
0000	-00 38	34 13	27 44		*8 31	4732 9
0010	-00 40	34 12	27 44	0 006		4733 1
0020	-00 41	34 12	27 44	0 013		4733 6
0030	-00 41	34 12	27 44	0 020		4734 2
0044	-00 45	34 12	27 44		*8 18	4734 4
0050	-00 51	34 14	27 46	0 032		4733 9
0075	-00 69	34 20	27 51	0 048		4732 9
0089	-00 75	34 24	27 55		*7 97	4732 9
0100	-00 72	34 27	27 57	0 061		4734 2
0150	-00 56	34 41	27 68	0 085		4740 2
0179	-00 44	34 47	27 72		*6 40	4744 1
0200	-00 29	34 51	27 75	0 104		4747 8
0250	-00 01	34 58	27 79	0 121		4755 4
0270	00 07	34 60	27 80		*5 55	4757 9
0300	00 14	34 60	27 80	0 137		4760 7
0362	00 26	34 61	27 80		*5 20	4766 3
0400	00 31	34 61	27 80	0 168		4769 3
0454		34 62			*4 97	
0500	00 41	34 64	27 81	0 199		4776 9
0546	00 44	34 66	27 83		*4 97	4780 1
0600	00 45	34 66	27 83	0 228		4783 5
0732	00 46	34 66	27 83		*4 95	4791 5
0800	00 49	34 66	27 83	0 286		4796 0
0918	00 57	34 64	27 80		*4 88	4804 1

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0008	12	13	956	02	60	42S	040	49W	1097	06

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	29	22	70	01 4	00 7	91	02	8	8	09	3	34	2	2		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	00 25	34 28	27 53	0 000		4743 2
0000	00 25	34 28	27 53		*7 96	4743 2
0010	00 25	34 27	27 53	0 006		4743 7
0020	00 25	34 26	27 52	0 011		4744 3
0030	00 24	34 25	27 51	0 017		4744 7
0045	00 23	34 24	27 50		*7 87	4745 4
0050	00 21	34 24	27 50	0 029		4745 3
0075	00 13	34 24	27 51	0 044		4745 6
0090	00 09	34 24	27 51		*7 90	4745 9
0100	00 04	34 27	27 54	0 058		4745 9
0150	00 02	34 38	27 63	0 084		4749 0
0181	-00 02	34 45	27 68		*6 13	4750 5
0200	00 13	34 49	27 71	0 105		4754 1
0250	00 45	34 59	27 77	0 124		4762 4
0272	00 55	34 62	27 79		*5 23	4765 3
0300	00 62	34 65	27 81	0 140		4768 2
0365	00 73	34 70	27 84		*4 98	4773 9
0400	00 73	34 72	27 86	0 168		4776 1
0459	00 72	34 73	27 87		*4 90	4779 5
0554	*00 12	*34 49	*27 71		*6 03	*4775 0

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	′	°	′		
00561	0009	12	13	956	13	60	33S	037	20W	2194	16

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	31	22	72	01 4	00 6	86	02	6	8	34	3	36	2	7	09	06

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-00 70	34 08	27 42	0 000		4727 7
0000	-00 70	34 08	27 42		*8 14	4727 7
0010	-00 70	34 10	27 43	0 007		4728 4
0020	-00 70	34 12	27 45	0 013		4729 1
0030	-00 71	34 13	27 46	0 019		4729 6
0043	-00 71	34 14	27 47		*8 14	4730 4
0050	-00 65	34 13	27 46	0 032		4731 7
0075	-00 45	34 09	27 41	0 048		4736 1
0087		34 08			*8 14	
0100	-00 27	34 12	27 43	0 065		4740 5
0150	00 06	34 28	27 54	0 095		4749 2
0177	00 21				*5 78	
0200	00 32	34 41	27 63	0 121		4756 7
0250	00 52	34 51	27 70	0 142		4763 1
0300	00 67	34 58	27 75	0 161		4768 6
0359	00 78	34 64	27 79		*4 88	4774 0
0400	00 78	34 63	27 78	0 196		4776 4
0500	00 77	34 62	27 78	0 229		4782 2
0508	00 77	34 62	27 78		*4 84	4782 7
0600	00 63	34 59	27 76	0 264		4785 9
0688	00 54	34 59	27 77		*4 80	4789 8
0800	00 53	34 64	27 81	0 330		4796 5
0870	00 51	34 66	27 82			4800 5
1000	00 47	34 65	27 82	0 391		4807 6
1144	00 39	34 64	27 82		*4 84	4814 9
1200	00 34	34 65	27 83	0 450		4817 5
1235	00 32	34 65	27 83		*4 87	4819 3
1421	00 36	34 67	27 84		*4 93	4831 0
1500	00 36	34 67	27 84	0 535		4835 7
1607	00 33	34 66	27 83		*5 01	4841 6

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0010	12	14	956	01	60	04S	033	35W	3733	25

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
08	25	22	69	00 8	50 3	81	70	0	8	36	2	36	1	6		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 21	33 97	27 27	0 000		4718 9
0000	-01 21	33 87	27 27		*8 17	4718 9
0010	-01 20	33 90	27 29	0 008		4719 8
0020	-01 20	33 94	27 32	0 016		4720 5
0030	-01 20	33 97	27 35	0 023		4721 2
0049	-01 19	34 04	27 40		*8 14	4722 8
0050	-01 20	34 04	27 40	0 037		4722 7
0075	-01 21	34 15	27 49	0 053		4724 5
0098	-01 22	34 24	27 57		*7 30	4726 2
0100	-01 18	34 24	27 56	0 068		4726 9
0150	-00 38	34 36	27 63	0 092		4742 8
0196	00 17	34 46	27 68		*5 86	4754 4
0200	00 21	34 47	27 69	0 114		4755 3
0250	00 58	34 60	27 77	0 133		4764 4
0295	00 77	34 66	27 81		*5 01	4770 2
0300	00 77	34 66	27 81	0 149		4770 5
0394	00 68	34 64	27 80		*4 94	4774 6
0400	00 68	34 64	27 80	0 180		4775 0
0493	00 60	34 65	27 81		*4 80	4779 4
0500	00 59	34 65	27 81	0 211		4779 6
0593	00 51	34 64	27 81		*4 80	4783 9
0600	00 51	34 64	27 81	0 242		4784 3
0792	00 49	34 69	27 85		*4 76	4795 7
0800	00 50	34 69	27 85	0 300		4796 3
0992	00 56				*4 76	
1000	00 55	34 68	27 84	0 355		4808 9
1200	00 38	34 67	27 84	0 411		4818 2
1200	00 38	34 67	27 84		*4 81	4818 2
1500	00 24	34 67	27 85	0 492		4833 9
1500	00 24	34 67	27 85		*4 88	4833 9
2000	00 04	34 59	27 79	0 635		4860 2
2000	00 04	34 59	27 79		*5 11	4860 2
2500	-00 10	34 61	27 82	0 779		4887 8
2500	-00 10	34 61	27 82		*5 23	4887 8

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0011	12	15	956	01	59	04S	028	30W	3211	04

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
14	27	22	92	51 2	51 6	97	74		9	30	2	29	1	5		

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-00 23	33 96	27 30	0 000		4734 5
0000	-00 23	33 96	27 30		*7 94	4734 5
0010	-00 32	33 97	27 31	0 008		4733 7
0020	-00 39	33 98	27 32	0 015		4733 3
0030	-00 45	33 99	27 33	0 023		4733 0
0040	-00 50	34 01	27 35		*7 86	4732 9
0050	-00 42	34 06	27 39	0 037		4734 9
0075	-00 23	34 17	27 47	0 054		4739 8
0100	-00 05	34 27	27 54	0 069		4744 5
0150	00 26	34 44	27 66	0 093		4752 9
0200	00 51	34 57	27 75	0 113		4760 2
0207	00 54	34 58	27 76		*5 17	4761 1
0250	00 70	34 62	27 78	0 130		4766 3
0300	00 84	34 65	27 80	0 147		4771 5
0379	00 93	34 68	27 81		*4 83	4777 6

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0012	12	15	956	13	59	28S	025	09W	3395	28

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	29	22	96	00 0	50 6	89	01	4	2	31	2	29	1	7	02	14

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 06	33 32	26 82	0 000		4718 8
0000	-01 06	33 32	26 82		*8 03	4718 8
0010	-01 24	33 54	27 00	0 012		4717 6
0020	-01 38	33 73	27 16	0 021		4716 8
0030	-01 50	33 89	27 29	0 030		4716 2
0046	-01 62	34 10	27 46		*7 87	4716 2
0050	-01 61	34 13	27 49	0 044		4716 7
0075	-01 57	34 27	27 60	0 058		4719 4
0092	-01 55	34 34	27 66		*7 23	4721 0
0100	-01 49	34 35	27 56	0 069		4722 5
0138	-01 13	34 42	27 71		*6 52	4730 7
0150	-00 95	34 45	27 73	0 089		4734 4
0183	-00 50	34 51	27 76		*5 71	4743 6
0200	-00 32	34 53	27 76	0 107		4747 4
0250	00 10	34 59	27 79	0 124		4757 1
0275	00 25	34 61	27 80		*4 86	4760 9
0300	00 31	34 62	27 80	0 139		4763 4
0367	00 42	34 63	27 81		*4 56	4769 1
0400	00 42	34 64	27 81	0 170		4771 1
0500	00 43	34 65	27 82	0 199		4777 2
0551	00 43	34 66	27 83		*4 43	4780 3
0600	00 42	34 68	27 85	0 227		4783 1
0735	00 42	34 71	27 87		*4 53	4791 3
0800	00 44	34 70	27 86	0 280		4795 4
0921	00 47	34 69	27 85		*4 60	4803 0
1000	00 37	34 69	27 86	0 332		4806 2
1094	00 28	34 69	27 86		*4 69	4810 4
1200	00 22	34 69	27 86	0 383		4815 8
1375	00 12	34 69	27 87		*4 94	4824 7
1500	00 05	34 69	27 87	0 455		4831 1
1846	-00 08	34 70	27 89		*5 21	4849 7
2000	-00 10	34 70	27 89	0 566		4858 5
2318	-00 12	34 70	27 89		*5 46	4877 1
2500	-00 12	34 70	27 89	0 670		4887 9
2792	-00 11	34 69	27 88		*5 51	4905 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0013	12	17	956	08	61	01S	015	39W	3971	25

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	04	22	88	50 9	51 1	97	70	0	8	04	1	00	0	3	05	15

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 78	34 22	27 57	0 000		4711 4
0000	-01 78	34 22	27 57		*7 31	4711 4
0010	-01 79	34 22	27 57	0 005		4711 8
0020	-01 79	34 22	27 57	0 011		4712 4
0030	-01 80	34 23	27 57	0 016		4712 9
0049	-01 81	34 23	27 57		*7 28	4713 9
0050	-01 79	34 23	27 57	0 026		4714 3
0075	-01 40	34 31	27 63	0 039		4722 3
0099	-01 03	34 39	27 68		*6 86	4729 8
0100	-01 01	34 40	27 69	0 050		4730 2
0148	-00 29	34 58	27 80		*5 21	4745 0
0150	-00 25	34 58	27 80	0 068		4745 7
0198	00 42	34 65	27 82		*4 47	4759 1
0200	00 42	34 65	27 82	0 083		4759 2
0250	00 47	34 64	27 81	0 097		4762 9
0297	00 49	34 64	27 81		*4 37	4766 0
0300	00 49	34 64	27 81	0 112		4766 2
0397	00 46	34 68	27 84		*4 29	4771 7
0400	00 46	34 68	27 84	0 141		4771 8
0500	00 40	34 68	27 85	0 168		4776 9
0546	00 38	34 68	27 85		*4 50	4779 3
0600	00 37	34 69	27 86	0 194		4782 4
0796	00 35	34 70	27 87		*4 63	4793 8
0800	00 35	34 70	27 87	0 245		4794 1
0995	00 37	34 66	27 83		*4 74	4805 8
1000	00 36	34 66	27 83	0 299		4805 9
1195	00 14	34 63	27 82		*4 93	4814 1
1200	00 14	34 63	27 82	0 355		4814 4
1495	-00 02	34 65	27 85		*5 06	4829 6
1500	-00 02	34 65	27 85	0 437		4829 9
1795	-00 08	34 64	27 84		*5 15	4846 4
1995	-00 03	34 67	27 86		*5 24	4859 2
2000	-00 03	34 67	27 86	0 561		4859 5
2495	-00 27	34 64	27 85		*5 68	4885 0

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0014	12	18	956	05	62	39S	014	21W	5069	03

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	31	22	97	50 1	50 3	97	45		9	00	0	00	0	3	02	

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/oo	σ_t	$\Sigma\Delta D$	O_2ml/l	V_f
0000	-01 70	34 26	27 60	0 000		4712 8
0000	-01 70	34 26	27 60			4712 8
0003	-01 70	34 26	27 60		*7 29	4713 0
0010	-01 72	34 26	27 60	0 005		4713 1
0020	-01 74	34 26	27 60	0 010		4713 4
0030	-01 76	34 27	27 61	0 015		4713 7
0050	-01 78	34 27	27 61	0 025		4714 6
0053	-01 79	34 27	27 61		*7 28	4714 6
0075	-01 69	34 36	27 68	0 036		4717 9
0100	-01 33	34 45	27 74	0 046		4725 4
0103	-01 27	34 46	27 75		*6 47	4726 6
0150	00 27	34 61	27 80	0 063		4753 8
0153	00 33	34 62	27 80		*4 74	4754 9
0200	00 66	34 66	27 82	0 078		4762 9
0203	00 67	34 66	27 81		*4 46	4763 2
0250	00 65	34 66	27 82	0 093		4765 7
0253	00 64	34 66	27 82		*4 43	4765 7

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DATE DAY	DATE YR.	DATE HR.	LATITUDE °	LATITUDE '	LONGITUDE °	LONGITUDE '	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0015	12	19	956	01	64	18S	013	28W	5066	35

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
06	02	22	96	51 5	51 8	95	41	0	8	29	1	00	0	7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 82	34 29	27 62	0 000		4711 1
0000	-01.82	34 29	27 62		*7 08	4711 1
0010	-01 82	34 31	27 64	0 005		4711 7
0020	-01 82	34 34	27 66	0 009		4712 5
0030	-01 81	34 36	27 68	0 013		4713 3
0049	-01 81	34 39	27 70		*7 03	4714 6
0050	-01 81	34 39	27 70	0 022		4714 6
0075	-01 75	34 41	27 72	0 031		4717 2
0098	-01 70	34 44	27 74		*6 68	4719 5
0100	-01 64	34 45	27 75	0 041		4720 6
0147		34 57			*6 04	
0150	-00 36	34 58	27 81	0 057		4744 1
0197	00 34	34 69	27 86		*4 75	4758 0
0200	00 36	34 69	27 86	0 071		4758 5
0246	00 55	34 71	27 86		*4 47	4764 2
0250	00 55	34 71	27 86	0 084		4764 4
0295		34 70			*4 44	
0300	00 53	34 70	27 86	0 096		4767 0
0400	00 48	34 70	27 86	0 122		4772 2
0492	00 45	34 69	27 85		*4 43	4777 2
0500	00 45	34 69	27 85	0 148		4777 7
0600	00 42	34 68	27 85	0 175		4783 1
0690	00 39	34 67	27 84		*4 54	4788 0
0800	00 35	34 68	27 85	0 228		4794 0
0987	*00 29	34 69	*27 86		*4 75	*4804 2
1000	00 27	34 69	27 86	0 280		4804 7
1200	00 19	34 71	27 88	0 329		4815 5
1464	00 08	34 71	27 89		*4 99	4829 5
1500	00 06	34 71	27 89	0 396		4831 3
1964	-00 14	34 66	27 86		*5 24	4855 6
2000	-00 15	34 66	27 86	0 510		4857 6
2464	-00 21	34 65	27 86		*5 53	4884 1
2500	-00 21	34 65	27 86	0 626		4886 3
2964	*-00 28	34 64	*27 85		*5 54	*4912 6
3000	-00 28	34 64	27 85	0 740		4914 7
3464	-00 34	34 65	27 86		*5 61	4941 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0016	12	20	956	22	67	33S	011	41W	4931	10

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
12	11	22	92	51 7	52 2	88	70	6	8	09	2	00	0	6	14	09

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 74	34 17	27 52	0 000		4711 8
0000	-01 74	34 17	27 52		*6 76	4711 8
0010	-01 55	34 21	27 55	0 006		4715 6
0020	-01 37	34 25	27 58	0 011		4719 2
0030	-01 19	34 28	27 60	0 016		4722 7
0050	-00 86	34 35	27 64	0 026		4729 4
0075	-00 49	34 42	27 68	0 037		4736 9
0100	-00 17	34 49	27 72	0 046		4743 6
0150	00 34	34 60	27 79	0 064		4754 8
0192	00 63	34 66	27 82		*4 62	4761 9
0200	00 67	34 67	27 82	0 079		4763 1
0240	00 80	34 70	27 84		*4 52	4767 5
0250	00 79	34 70	27 84	0 094		4768 0
0288	00 76	34 70	27 84		*4 54	4769 8
0300	00 75	34 70	27 84	0 107		4770 3
0384	00 70	34 70	27 84		*4 56	4774 6
0400	00 68	34 70	27 85	0 135		4775 2
0500	00 60	34 68	27 83	0 162		4779 9
0577	00 55	34 68	27 84		*4 55	4783 7
0600	00 54	34 68	27 84	0 190		4784 9
0770	00 47	34 70	27 86		*4 57	4794 1
*0963		34 67			*4 65	

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0017	12	27	956	08	71	18S	013	32W	0220	02

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	22	22	02	51 7	52 2	88	02	4	2	00	0	00	0	7	05	20

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 76	34 27	27 61	0 000		4711 9
0000	-01 76	34 27	27 61		*7 39	4711 9
0010	-01 79	34 31	27 64	0 005		4712 2
0020	-01 82	34 35	27 67	0 009		4712 5
0030	-01 84	34 37	27 69	0 013		4712 9
0047	-01 86	34 41	27 72		*7 47	4713 7
0050	-01 86	34 41	27 72	0 021		4713 9
0075	-01 84	34 42	27 73	0 031		4715 8
0094	-01 83	34 42	27 73		*7 47	4717 1
0100	-01 85	34 42	27 73	0 040		4717 1
0141	-01 90	34 41	27 72		*7 47	4718 7
0150	-01 90					
0188	-01 83				*7 36	

SURFACE OBSERVATIONS												
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0018	12	28	956	04	72	005	015	14W	0919	09

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	22	22	02	53 2	53 6	92	02	0	8	22	1	00	0	7	05	15

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/oo	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 79	34 26	27 60	0 000		4711 4
0000	-01 79	34 26	27 60		*7 31	4711 4
0010	-01 81	34 28	27 61	0 005		4711 8
0020	-01 84	34 30	27 63	0 010		4712 0
0030	-01 85	34 32	27 65	0 014		4712 5
0050	-01 88	34 34	27 67	0 023		4713 3
0050	-01 88	34 34	27 67		*7 32	4713 3
0075	-01 89	34 33	27 66	0 034		4714 6
0100	-01 89	34 33	27 66	0 045		4716 1
0100	-01 89	34 33	27 66		*7 40	4716 1
0150	-01 86	34 35	27 67	0 066		4719 6
0200	-01 84	34 37	27 69	0 087		4723 0
0200	-01 84	34 37	27 69		*7 50	4723 0
0250	-01 84	34 38	27 70	0 107		4726 0
0300	-01 84	34 38	27 70	0 126		4729 0
0300	-01 84	34 38	27 70		*7 50	4729 0
0399	-01 77	34 38	27 69		*6 93	4736 0
0400	-01 77	34 38	27 69	0 165		4736 0
0499		34 42			*7 06	
0500	-01 58	34 42	27 72	0 202		4745 2
0600	-01 27	34 46	27 75	0 237		4756 2
0698	-00 86					
0800		34 54				
0897		34 58			*5 22	

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0019	01	11	957	00	77	37S	043	15W	0430	04

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
02	27	22	08	53 3	53 9	88	02	4	7	00	0	00	0	7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 69	34 48	27 77	0 000		4714 0
0000	-01 69	34 48	27 77		*7 46	4714 0
0010	-01 86	34 47	27 77	0 003		4711 8
0020	-01 97	34 47	27 77	0 007		4710 7
0020	-01 97	34 47	27 77		*7 57	4710 7
0030	-01 93	34 48	27 78	0 010		4711 9
0050	-01 88	34 49	27 79	0 016		4714 0
0050	-01 88	34 49	27 79		*7 35	4714 0
0075	-01 91	34 51	27 80	0 024		4715 1
0100	-01 93	34 52	27 81	0 032		4716 3
0100	-01 93	34 52	27 81		*7 32	4716 3
0150	-01 94	34 53	27 82	0 046		4719 1
0200	-01 94	34 55	27 84	0 059		4722 2
0200	-01 94	34 55	27 84		*7 29	4722 2
0250	-01 93	34 59	27 87	0 072		4725 5
0300	-01 92	34 62	27 89	0 082		4728 7
0300	-01 92	34 62	27 89		*7 32	4728 7
0400	-01 93	34 67	27 93	0 100		4734 8
0400	-01 93	34 67	27 93		*7 16	4734 8

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0020	01	12	957	01	77	08S	045	10W	0282	03

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
03	25	22	06	54 4	54 9	89	02	6	7	00	0	00	0	7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 86	34 52	27 81	0 000		4711 4
0000	-01 86	34 52	27 81		*7 46	4711 4
0010	-01 80	34 55	27 83	0 003		4713 1
0020	-01 77	34 58	27 86	0 006		4714 3
0020	-01 77	34 58	27 86		*7 32	4714 3
0030	-01 82	34 61	27 88	0 008		4714 2
0050	-01 91	34 65	27 92	0 012		4714 2
0050	-01 91	34 65	27 92		*7 35	4714 2
0075	-01 97	34 67	27 94	0 017		4714 8
0100	-02 01	34 68	27 94	0 021		4715 7
0100	-02 01	34 68	27 94		*7 38	4715 7
0150	-02 00	34 69	27 95	0 029		4718 9
0200	-01 97	34 69	27 95	0 037		4722 3
0200	-01 97	34 69	27 95		*7 23	4722 3
0250	-01 91	34 71	27 97	0 044		4726 3
0265	-01 89	34 72	27 97		*7 25	4727 6

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	′	LONGITUDE °	′	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0021	01	14	957	04	77	16S	048	12W	0292	03

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
03	27	22	97	55 6	55 9	91	70	0	8	00	0	00	0	7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2 ml/l	V_f
0000	-01 63	34 56	27 84	0 000		4715 3
0000	-01 63	34 56	27 84		*7 84	4715 3
0010	-01 66	34 47	27 76	0 003		4715 0
0020	-01 68	34 41	27 72	0 007		4715 0
0030	-01 70	34 36	27 68	0 011		4715 1
0030		34 36			*7 70	
0050	-01 75	34 43	27 73	0 019		4715 8
0075	-01 79	34 51	27 80	0 027		4717 0
0100	-01 83	34 57	27 85	0 034		4718 1
0100	-01 83	34 57	27 85		*7 35	4718 1
0150	-01 87	34 64	27 91	0 045		4720 7
0200	-01 89	34 69	27 95	0 054		4723 6
0200	-01 89	34 69	27 95		*7 43	4723 6
0250	-01 89	34 70	27 96	0 062		4726 6
0280	-01 88	34 70	27 96		*7 45	4728 5

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	′	LONGITUDE °	′	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00561	0022	01	16	957	03	75	35S	057	48W	0630	06

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
02	27	22	97	52 8	53 4	88	71	6	8	00	0	00	0	7	09	18

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2 ml/l	V_f
0000	-01 17	34 50	27 77	0 000		4722 2
0000	-01 17	34 50	27 77		*7 79	4722 2
0010	-01 17	34 50	27 77	0 003		4722 8
0019	-01 17	34 50	27 77		*8 02	4723 4
0020	-01 18	34 50	27 77	0 007		4723 3
0030	-01 30	34 52	27 79	0 010		4722 1
0048		34 55			*7 81	
0050	-01 52	34 55	27 83	0 016		4719 9
0075	-01 75	34 58	27 86	0 023		4717 9
0097	-01 92	34 61	27 89		*7 31	4716 6
0100	-01 92	34 61	27 89	0 028		4716 8
0150	-01 98	34 65	27 92	0 039		4719 0
0200	-02 01	34 68	27 94	0 047		4721 6
0250	-02 01	34 70	27 96	0 055		4724 7
0290	-02 03	34 72	27 98		*7 51	4726 8
0300	-02 03	34 72	27 98	0 062		4727 4
0400	-01 97	34 74	27 99	0 073		4734 4
0485	-01 87	34 75	28 00		*7 35	4741 1
0500		34 75				
0600		34 76				
0602		34 76			*7 21	

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0023	01	16	957	18	76	02S	056	30W	0595	00

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	16	22	98	55 3	55 6	91	71	6	8	00	0	00	0	6	05	21

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	$\Sigma\Delta D$	O_2ml/l	V_f
0000	-01 64	34 60	27 87	0 000		4715 3
0000	-01 64	34 60	27 87		*7 93	4715 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0024	01	20	957	21	77	21S	044	30W	0300	03

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
03	27	22	99	56 2	56 7	82	02	4	6	00	0	00	0	7	05	17

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	$\Sigma\Delta D$	O_2ml/l	V_f
0000	-01 81	34 59	27 87	0 000		4712 5
0000	-01 81	34 59	27 87		*7 65	4712 5
0010	-01 82	34 59	27 87	0 002		4713 0
0020	-01 83	34 59	27 87	0 005		4713 4
0030	-01 84	34 60	27 88	0 007		4713 9
0050	-01 87	34 60	27 88	0 012		4714 6
0050	-01 87	34 60	27 88		*7 56	4714 6
0075	-01 94	34 62	27 89	0 018		4715 1
0100	-01 98	34 63	27 90	0 023		4715 9
0100	-01 98	34 63	27 90		*7 57	4715 9
0150	-02 01	34 64	27 91	0 033		4718 5
0150	-02 01	34 64	27 91		*7 56	4718 5
0200	-01 95	34 66	27 93	0 042		4722 5
0200	-01 95	34 66	27 93		*7 59	4722 5
0250	-01 90	34 67	27 93	0 051		4726 3
0290	-01 86	34 67	27 93		*7 56	4729 3

SURFACE OBSERVATIONS												
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0025	02	13	957	17	75	07S	025	55W	0331	03

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	02	22	86	51 8	52 2	90	02	6	8	02	3	00	0	7	05	16

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2ml/l	V_t
0000	-00 62	34 03	27 37	0 000		4728 8
0000	-00 62	34 03	27 37		*7 20	4728 8
0010	-00 62	34 06	27 40	0 007		4729 5
0020	-00 63	34 11	27 44	0 014		4730 1
0024	-00 63	34 13	27 45		*7 33	4730 5
0030	-00 89	34 19	27 51	0 020		4727 0
0048	-01 45	34 33	27 65		*7 11	4720 0
0050	-01 47	34 33	27 65	0 030		4719 8
0072	-01 66	34 38	27 69		*6 79	4718 3
0075	-01 69	34 39	27 70	0 041		4718 0
0096	-01 84	34 44	27 75		*6 63	4717 1
0100	-01 84	34 44	27 75	0 050		4717 3
0150	-01 83	34 46	27 76	0 068		4720 6
0196	-01 82	34 47	27 77		*6 61	4723 5
0200	-01 82	34 47	27 77	0 084		4723 7
0250	-01 83	34 47	27 77	0 100		4726 6
0296	-01 84	34 46	27 76		*6 56	4729 1

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0026	02	14	957	18	72	47S	021	07W	3931	09

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	05	22	01	50 8	51 1	95	10	0	8	05	2	00	0	6	09	10

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2ml/l	V_t
0000	-01 23	33 59	27 04	0 000		4717 3
0000	-01 23	33 59	27 04		*7 37	4717 3
0010	-01 24	33 70	27 13	0 010		4718 3
0020	-01 26	33 80	27 21	0 019		4719 0
0030	-01 29	33 89	27 28	0 027		4719 5
0047	-01 36	34 04	27 41		*6 77	4720 0
0050	-01 39	34 06	27 42	0 042		4719 8
0075	-01 58	34 24	27 58	0 057		4719 1
0094	-01 68	34 34	27 66		*6 30	4719 1
0100	-01 68	34 34	27 66	0 068		4719 4
0150	-01 69	34 35	27 67	0 090		4722 3
0187	-01 69	34 36	27 68		*5 91	4724 5
0200	-01 63	34 37	27 68	0 111		4726 3
0250	-01 39	34 43	27 72	0 130		4733 3
0300	-01 16	34 47	27 75	0 148		4740 1
0367	-00 85	34 52	27 78		*5 44	4749 1
0400	-00 65	34 53	27 78	0 181		4754 2
0500	-00 16	34 56	27 78	0 213		4767 9
0560	00 04	34 58	27 79		*4 69	4774 6
0600	00 08	34 59	27 79	0 245		4777 6
0746	00 21				*4 55	
0800	00 24	34 62	27 81	0 307		4792 1
0940	00 30	34 63	27 81		*4 58	4801 3

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0027	02	28	957	15	46	36S	076	10W	4097	23

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	32	22	22	11 9	10 7	86	02	6	8	32	2	00	0	7	14	07

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	13 05	33 17	24 99	0 000		4905 7
0000	13 05	33 17	24 99		*5 91	4905 7
0010	12 94	33 25	25 07	0 029		4905 4
0019	12 85	33 30	25 13		*5 83	4905 1
0020	12 84	33 30	25 13	0 058		4905 1
0030	12 78	33 31	25 15	0 087		4905 0
0047	12 68	33 33	25 18		*5 62	4905 0
0050	12 32	33 37	25 28	0 142		4901 3
0075	09 82	33 67	25 97	0 202		4874 8
0096	08 46	33 84	26 32		*5 59	4860 1
0100	08 40	33 85	26 33	0 249		4859 6
0144	07 84	33 96	26 50		*5 11	4855 6
0150	07 79	33 97	26 52	0 331		4855 4
0193	07 42				*3 94	
0200	07 35	34 03	26 63	0 406		4853 0
0250	06 85	34 09	26 74	0 476		4849 8
0300	06 40	34 14	26 84	0 541		4847 1
0388	05 75	34 20	26 97		*4 89	4844 0
0400	05 72	34 20	26 98	0 660		4844 3
0500	05 45	34 24	27 04	0 772		4846 8
0584	*05 10	34 25	*27 09		*5 56	*4847 2
0600	05 11	34 25	27 09	0 878		4848 2
0690	04 75	34 25	27 13		*5 32	4848 7
0800	04 18	34 27	27 21	1 077		4847 5
0875	03 85	34 29	27 26		*4 31	4847 5
1000	03 55	34 33	27 32	1 256		4850 9
1200	03 13	34 39	27 41	1 416		4857 1
1353	02 87	34 43	27 46		*3 02	4862 7
1500	02 70	34 46	27 50	1 632		4869 1
1840	02 36				*3 02	
2000	02 23	34 54	27 61	1 948		4892 3
2332	02 02	34 56	27 64		*3 32	4909 0

SURFACE OBSERVATIONS												
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0028	03	01	957	13	42	25S	075	09W	1554	12

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	34	22	18	15 0	12 8	78	02	6	8	32	2	00	0	7	14	09

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_t
0000	15 05	33 20	24 60	0 000		4927 4
0000	15 05	33 20	24 60		*5 98	4927 4
0010	14 38	33 38	24 88	0 032		4921 6
0020	13 72	33 53	25 13	0 062		4915 6
0030	13 06	33 65	25 36	0 089		4909 4
0050	11 77	33 81	25 73	0 138		4896 7
0050	11 77	33 81	25 73		*5 78	4896 7
0075	10 20	33 85	26 04	0 192		4880 0
0075	10 20	33 85	26 04		*5 70	4880 0
0100	09 20	33 91	26 25	0 239		4869 7
0100	09 20	33 91	26 25		*5 23	4869 7
0150	08 68	34 17	26 54	0 322		4867 3
0150	08 68	34 17	26 54		*2 91	4867 3
0200	08 62	34 35	26 69	0 396		4870 3
0200	08 62	34 35	26 69		*1 47	4870 3
0250	08 52	34 36	26 71	0 465		4872 0
0300	08 28	34 36	26 75	0 534		4872 0
0300	08 28	34 36	26 75		*1 27	4872 0
0400	07 03	34 34	26 92	0 662		4862 0
0496	06 06	34 33	27 04		*4 24	4855 1
0500	06 03	34 33	27 04	0 777		4854 9
0600	05 40	34 32	27 11	0 884		4852 4
0793	04 41	34 31	27 22		*4 66	4850 4
0800	04 38	34 31	27 22	1 080		4850 4
0991	03 73	34 43	27 38		*3 72	4853 3
1000	03 70	34 43	27 39	1 252		4853 4
1189	03 15	34 51	27 50		*2 94	4857 3

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0029	03	01	957	23	4C	44S	074	48W	1554	12

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	36	22	16	15 6	13 4	78	C2	6	8	32	2	00	0	7	14	06

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	15 22	33 30	24 64	0 000		4929 6
0000	15 22	33 30	24 64		*6 59	4929 6
0010	15 16	33 31	24 66	0 033		4929 6
0020	15 10	33 31	24 67	0 066		4929 6
0020	15 10	33 31	24 67		*5 91	4929 6
0030	13 62	33 59	25 20	0 096		4915 4
0030	13 62	33 59	25 20		*5 66	4915 4
0050	11 64	33 80	25 75	0 147		4895 2
0050	11 64	33 80	25 75		*5 54	4895 2
0075	10 23	33 94	26 11	0 199		4880 7
0075	10 23	33 94	26 11		*5 72	4880 7
0100	09 45	34 03	26 31	0 245		4873 2
0100	09 45	*33 22	*25 68		*5 82	*4870 0
0150	09 34	34 20	26 46	0 329		4875 5
0159	09 31	34 23	26 49		*2 58	4875 8
0200	09 21	34 41	26 64	0 406		4877 8
0240	08 95	34 51	26 76		*1 18	4877 3
0250	08 82	34 51	26 78	0 475		4876 3
0300	08 21	34 51	26 88	0 539		4871 7
0319	07 98	34 51	26 91		*1 53	4870 0
0400	07 06	34 42	26 97	0 658		4862 7
0481	06 27	34 36	27 03		*3 64	4857 0
0500	06 14	34 36	27 05	0 770		4856 5
0600	05 51	34 37	27 14	0 875		4854 1
0800	04 46	34 39	27 27	1 065		4851 9
0809	04 42	34 39	27 28		*4 41	4851 9
1000	03 70	34 45	27 40	1 230		4853 5
1200	03 23	34 54	27 52	1 373		4859 2
1230	03 18	34 56	27 54		*2 86	4860 3

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00561	0030	03	15	957	18	31	48S	074	06W	3749	25

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	36	22	22	19 4	14 8	60	02	4	1	02	2	20	5	7	09	20

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2 ml/l	V_f
0000	19 00	34 39	24 57	0 000		4971 2
0000	19 00	34 39	24 57		*5 00	4971 2
0010	18 85	34 41	24 63	0 033		4970 5
0020	18 73	34 42	24 67	0 067		4970 0
0030	18 66	34 43	24 69	0 099		4969 9
0030	18 66	34 43	24 69		*5 00	4969 9
0040	18 63	34 43	24 70		*5 07	4970 3
0050	18 48	34 43	24 74	0 164		4969 4
0050	18 48	34 43	24 74		*5 07	4969 4
0075	11 83	33 95	25 83	0 232		4899 4
0075	11 83	33 95	25 83		*5 02	4899 4
0100	11 39	33 95	25 91	0 286		4895 9
0100	*11 07	33 95	*25 97		*4 52	*4892 2
0150	10 56	34 29	26 32	0 383		4890 5
0200	09 78	34 49	26 61	0 464		4885 0
0200	09 78	34 49	26 61		*0 58	4885 0
0250	09 07	34 49	26 73	0 535		4879 3
0300	08 38	34 48	26 83	0 601		4873 7
0300	08 38	34 48	26 83		*1 00	4873 7
0400	07 04	34 40	26 96	0 724		4862 4
0500	05 92	34 35	27 07	0 835		4853 5
0500	05 92	34 35	27 07		*3 78	4853 5
0600	05 39	34 36	27 14	0 939		4852 5
0800	04 47	34 36	27 25	1 130		4851 9
0996	03 77	34 38	27 34		*2 43	4853 9
1000	03 76	34 38	27 34	1 304		4854 0
1200	03 34	34 42	27 41	1 463		4860 2
1493	02 85	34 47	27 50		*2 52	4870 9
1500	02 84	34 47	27 50	1 680		4871 1
1990	02 39	34 54	27 59		*2 84	4894 0
2000	02 38	34 54	27 59	2 004		4894 5
2480	01 94	34 57	27 65		*3 26	4916 7

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	′	°	′		
00561	0031	03	16	957	18	26	30S	075	08W	3676	25

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	20	22	22	20 3	17 8	78	03	8	2	19	2	20	1	7	02	25

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2 ml/l	V_t
0000	20 71	34 81	24 45	0 000		4988 5
0000	20 71	34 81	24 45		*4 86	4988 5
0010	20 61	34 81	24 47	0 035		4988 2
0020	20 50	34 81	24 50	0 069		4987 8
0030	20 40	34 81	24 53	0 104		4987 5
0030	20 40	34 81	24 53		*4 90	4987 5
0040		34 81			*4 84	
0050	18 66	34 60	24 82	0 170		4971 8
0050	18 66	34 60	24 82		*5 35	4971 8
0075	14 21	34 25	25 58	0 239		4926 9
0075	14 21	34 25	25 58		*5 19	4926 9
0100	12 71	34 17	25 83	0 297		4911 7
0100		34 17			*4 86	
0150	10 76	34 16	26 18	0 399		4892 3
0150	10 76	34 16	26 18		*3 85	4892 3
0200	10 21	34 47	26 52	0 485		4890 0
0200	10 21	34 47	26 52		*1 66	4890 0
0250	09 43	34 47	26 65	0 560		4883 6
0300	08 70	34 46	26 76	0 630		4877 6
0399	07 38	34 43	26 94		*1 61	4866 8
0400	07 37	34 43	26 94	0 757		4866 8
0498	06 24	34 39	27 06		*2 65	4857 8
0500	06 23	34 39	27 06	0 870		4857 8
0600	05 71	34 41	27 14	0 975		4856 9
0800	04 81	34 43	27 27	1 165		4856 8
0996	04 10	34 46	27 37		*1 93	4858 8
1000	04 09	34 46	27 37	1 336		4858 9
1200	03 63	34 48	27 43	1 492		4864 5
1493	03 05	34 51	27 51		*2 37	4873 9
1500	03 04	34 51	27 51	1 708		4874 1
2000	02 33	34 56	27 61	2 024		4893 9
2480	01 97	34 61	27 68		*3 31	4917 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	′	°	′		
00562	0004	02	20	957	10	42	22S	174	00E	1134	09

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
03	05	24	15	16 8	15 8	89	02	6	3		1	05	1	7		

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	17 53	34 49	25 02	0 000		4957 5
0000	17 53	34 49	25 02			4957 5
0008	17 17	34 50	25 11			4954 4
0010	17 11	34 49	25 12	0 029		4953 9
0017	16 35	34 49	25 29			4946 7
0020	15 51	34 54	25 52	0 056		4938 5
0025	14 44	34 60	25 80			4927 8
0030	14 24	34 62	25 86	0 079		4926 0
0042	13 78	34 66	25 99			4921 9
0050	13 43	34 67	26 07	0 120		4918 6
0075	12 55	34 68	26 25	0 167		4910 4
0083	12 34	34 69	26 30			4908 6
0100	12 09	34 71	26 37	0 211		4906 8
0123	11 78	34 74	26 45			4904 8
0150	11 53	34 81	26 55	0 291		4903 8
0162		*34 90				
0200	11 02	34 88	26 70	0 365		4901 2
0200	11 02	34 88	26 70			4901 2
0250	10 25	34 77	26 75	0 434		4894 6
0300	09 57	34 68	26 79	0 501		4889 1
0383	08 61	34 56	26 86			4881 8
0400	08 44	34 56	26 88	0 629		4880 7
0500	07 65	34 53	26 98	0 751		4876 6
0600	07 18	34 50	27 02	0 866		4876 5
0631	07 10	34 49	27 02			4877 2
0800		34 45				
0862	*07 15	34 43	*26 97			*4891 3

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00562	0005	03	11	957	18	77	51S	166	37E	0027	00

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
05	14	24	03	61 6	62 1	76		1	2					7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 83	34 06	27 44	0 000		4709 9
0000	-01 83	34 06	27 44			4709 9
0010	-01 83	34 05	27 43	0 007		4710 5
0020	-01 82	34 04	27 42	0 013		4711 2
0030	-01 82	34 03	27 41	0 020		4711 7
0030	-01 82	34 03	27 41			4711 7

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE °	'	LONGITUDE °	'	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00562	0006	03	13	957	09	72	18S	170	34E	0157	02

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
07	32	24	89	53 5	54 0	88		6	8					6		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 83	34 47	27 77	0 000		4711 7
0002	-01 83	34 47	27 77			4711 8
0010	-01 78	34 41	27 72	0 004		4712 8
0020	-01 73	34 35	27 67	0 008		4713 9
0030	-01 68	34 31	27 64	0 012		4715 2
0050	-01 62	34 25	27 59	0 022		4717 0
0075	-01 59	34 25	27 58	0 035		4719 0
0077	-01 58	34 25	27 58			4719 3
0100	-01 60	34 32	27 64	0 047		4720 6
0150	-01 79	34 70	27 95	0 062		4722 2
0155	-01 82	34 76	28 00			4722 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00562	0007	03	15	957	11	62	50S	165	23E	3292	04

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
04	16	24	98	02 8	02 3	91	44	8	7		3	32	2	6		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	02 45	33 90	27 08	0 000		4774 0
0000	02 45	33 90	27 08			4774 0
0010	02 79	33 91	27 06	0 010		4779 6
0010	02 79	33 91	27 06			4779 6
0020	02 55	33 91	27 08	0 020		4776 7
0020	02 55	33 91	27 08			4776 7
0030	02 46	33 93	27 10	0 030		4776 1
0030	02 46	33 93	27 10			4776 1
0050	00 79	34 23	27 46	0 046		4754 0
0050	00 79	34 23	27 46			4754 0
0075	00 83	34 49	27 67	0 059		4757 2
0075	00 83	34 49	27 67			4757 2
0100	01 04	34 61	27 75	0 069		4762 4
0100		34 61				
0150	01 37	34 66	27 77	0 087		4770 4
0150		34 66				
0200	01 57	34 70	27 79	0 104		4776 5
0200	01 57	34 70	27 79			4776 5
0250	01 64	34 70	27 78	0 120		4780 5
0250	01 64					
0300	01 58	34 70	27 79	0 137		4782 6
0300	01 58	34 70	27 79			4782 6
0400	01 56	34 70	27 79	0 170		4788 3
0400	01 56	34 70	27 79			4788 3

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR	HR.	°	'	°	'		
00562	0008	03	15	957	16	62	03S	164	51E	2085	01

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
08	09	24	90	02 3	02 0	95	45	4	7		3	31	2	3		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	03 00	33 90	27 03	0 000		4781 9
0000	03 00	33 90	27 03			4781 9
0010	03 01	33 91	27 04	0 010		4782 7
0010	03 01	33 91	27 04			4782 7
0019	03 06	33 92	27 04			4784 0
0020	03 05	33 91	27 03	0 021		4783 9
0029	02 99	33 89	27 02			4783 5
0030	02 99	33 90	27 03	0 031		4783 6
0048	02 93	33 97	27 09			4784 1
0050	02 84	33 97	27 10	0 051		4782 9
0072	01 62	34 01	27 23			4766 7
0075	01 30	34 03	27 27	0 074		4762 3
0097	-00 25	34 15	27 45			4740 7
0100	-00 16	34 17	27 47	0 092		4742 4
0145	01 26	34 45	27 61			4767 6

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00562	0009	03	15	957	21	61	15S	164	20E	3200	04

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	09	24	84	04 3	03 4	83	45				3	29	2	2		

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	03 02	33 95	27 07	0 000		4782 4
0000	03 02	33 95	27 07			4782 4
0010	03 11	33 96	27 07	0 010		4784 3
0010	03 11	33 96	27 07			4784 3
0019	03 10	33 95	27 06			4784 7
0020	03 10	33 95	27 06	0 020		4784 7
0028	*02 72	33 94	*27 09			*4779 8
0030	03 06	33 94	27 06	0 030		4784 7
0047	03 01	33 95	27 07			4785 1
0050	02 93	33 95	27 08	0 050		4784 1
0071	02 39	33 96	27 13			4777 7
0075	01 88	33 99	27 19	0 074		4770 6
0095	00 14	34 13	27 42			4746 5
0100	00 29	34 16	27 43	0 093		4749 2
0142	01 28	34 34	27 52			4767 3
0150	01 39	34 37	27 53	0 124		4769 5
0190	01 81	34 49	27 60			4778 6
0200	01 87	34 50	27 60	0 150		4780 1
0237	02 01	34 53	27 62			4784 4
0250	02 01	34 55	27 63	0 175		4785 3
0285	02 01	34 58	27 66			4787 5
0300	02 01	34 59	27 66	0 198		4788 4
0380	01 96	34 59	27 67			4792 5

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE ° '	LONGITUDE ° '	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00563	0001	11	04	956	03	77 40S	166 14E	0385	04

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
05	02	24	85	62 0	63 3	45	02	6	1					9	05	47

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 90	34 88	28 10	0 000		4712 4
0000	-01 90	34 88	28 10		*6 52	4712 4
0010	-01 91	34 89	28 11	0 000		4712 8
0010	-01 91	34 89	28 11		*6 69	4712 8
0020	-01 93	34 88	28 10	0 000		4713 1
0030	-01 94	34 88	28 10	0 001		4713 5
0050	-01 95	34 87	28 10	0 001		4714 5
0050	-01 95	34 87	28 10		*6 62	4714 5
0075	-01 93	34 87	28 10	0 002		4716 3
0100	-01 91	34 87	28 10	0 002		4718 1
0100	-01 91	34 87	28 10		*6 59	4718 1
0150	-01 90	34 88	28 10	0 003		4721 3
0200	-01 89	34 88	28 10	0 004		4724 4
0200	-01 89	34 88	28 10		*6 48	4724 4
0250	-01 90	34 89	28 11	0 004		4727 3
0300	-01 90	34 89	28 11	0 004		4730 3
0380	-01 94	34 90	28 12		*6 63	4734 4

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DAY	YR.	HR.	LATITUDE ° '	LONGITUDE ° '	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00563	0002	11	07	956	14	78 10S	162 31W	0622	06

WIND m/sec	DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	WET	HUMIDITY %	WEATHER	CLOUD TYPE	AMT.	SEA DIR.	AMT.	SWELL DIR.	AMT.	VIS.	WATER COL.	TRANS.
03	14	24	71	71 7	71 9	69	85	6	8					7		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 94	34 60	27 88	0 000		4710 5
0000	-01 94	34 60	27 88		*6 55	4710 5
0010	-02 01	34 56	27 85	0 002		4709 8
0010	-02 01	34 56	27 85		*6 66	4709 8
0020	-01 95	34 54	27 83	0 005		4711 3
0025	-01 93	34 53	27 82		*6 60	4711 9
0030	-01 93	34 52	27 81	0 008		4712 1
0050	-01 92	34 52	27 81	0 014		4713 5
0050	-01 92	34 52	27 81		*6 59	4713 5
0075	-01 90	34 64	27 91	0 020		4715 8
0100	-01 89	34 72	27 97	0 024		4717 8
0100	-01 89	34 72	27 97		*6 65	4717 8
0150	-01 88	34 68	27 94	0 032		4720 7
0200	-01 86	34 65	27 92	0 041		4723 9
0200	-01 86	34 65	27 92		*6 53	4723 9
0250	-01 74	34 63	27 90	0 051		4728 7
0300	-01 65	34 61	27 88	0 061		4733 0
0300	-01 65	34 61	27 88		*6 51	4733 0
0400	-01 70	34 61	27 88	0 083		4738 2
0500	-01 74	34 61	27 88	0 104		4743 5
0600	-01 78	34 61	27 88	0 124		4748 8
0625	-01 80	34 61	27 88		*6 66	4749 9

SURFACE OBSERVATIONS												
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00563	0003	11	08	956	21	76	18S	174	56E	0575	06

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
10		24	81	62 6	62 8	81	02	6	8					8	14	20

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 74	34 60	27 87	0 000		4713 7
0000	-01 74	34 60	27 87		*6 26	4713 7
0010	-01 82	34 57	27 85	0 003		4712 9
0010	-01 82	34 57	27 85		*6 35	4712 9
0020	-01 81	34 57	27 85	0 005		4713 6
0025	-01 80	34 57	27 85		*6 38	4714 1
0030	-01 81	34 58	27 86	0 008		4714 3
0050	-01 84	34 60	27 88	0 013		4715 1
0050	-01 84	34 60	27 88		*6 35	4715 1
0075	-01 84	34 67	27 93	0 018		4716 9
0100	-01 83	34 72	27 97	0 022		4718 7
0100	-01 83	34 72	27 97		*6 16	4718 7
0150	-01 86	34 76	28 01	0 028		4721 4
0200	-01 89	34 79	28 03	0 033		4724 0
0200	-01 89	34 79	28 03		*6 33	4724 0
0250	-01 94	34 81	28 05	0 036		4726 3
0300	-01 97	34 83	28 06	0 039		4728 9
0300	-01 97	34 83	28 06		*6 56	4728 9
0400	-01 95	34 84	28 07	0 042		4735 2
0500	-01 94	34 85	28 08	0 044		4741 3
0570	-01 89	34 85	28 08		*6 62	4746 3

SURFACE OBSERVATIONS												
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00563	0004	11	09	956	05	74	55S	174	53E	0320	03

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
11	22	24	80	59 5	60 3	72	02	6	7					8	14	22

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 81	34 44	27 74	0 000		4711 9
0000	-01 81	34 44	27 74		*6 46	4711 9
0010	-01 78	34 46	27 76	0 004		4713 0
0010	-01 78	34 46	27 76		*6 60	4713 0
0020	-01 77	34 44	27 74	0 007		4713 7
0025	-01 77	34 44	27 74		*5 96	4714 0
0030	-01 76	34 45	27 75	0 011		4714 5
0050	-01 73	34 47	27 77	0 018		4716 2
0050	-01 73	34 47	27 77		*6 05	4716 2
0075	-01 74	34 45	27 75	0 026		4717 5
0100	-01 74	34 44	27 74	0 035		4718 9
0100	-01 74	34 44	27 74		*6 01	4718 9
0150	-00 80	34 55	27 80	0 052		4737 1
0200	-00 40	34 62	27 84	0 066		4746 6
0200	-00 40	34 62	27 84		*5 47	4746 6
0250	-00 55	34 63	27 85	0 079		4747 3
0300	-01 24	34 64	27 89	0 090		4739 6
0310	-01 44	34 64	27 90		*6 21	4737 0

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00563	0005	11	09	956	14	73	47S	175	08E	0520	05

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
06	27	24	80	59 7	60 5	68	C1	6	3					8	14	23

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2 ml/l	V_t
0000	-01 80	34 70	27 96	0 000		4713 2
000C	-01 80	34 70	27 96		*6 46	4713 2
0010	-01 82	34 71	27 96	0 002		4713 5
0010	-01 82	34 71	27 96		*6 58	4713 5
0020	-01 84	34 70	27 96	0 003		4713 7
0025	-01 85	34 70	27 96		*6 63	4713 9
0030	-01 85	34 70	27 96	0 005		4714 2
0050	-01 84	34 70	27 96	0 008		4715 5
0050	-01 84	34 70	27 96		*6 45	4715 5
0075	-01 84	34 71	27 96	0 012		4717 0
0100	-01 83	34 71	27 96	0 015		4718 7
0100	-01 83	34 71	27 96		*6 40	4718 7
0150	-01 80	34 71	27 96	0 023		4722 1
0200	-01 77	34 70	27 95	0 030		4725 5
0200	-01 77	34 70	27 95		*6 36	4725 5
0250	-01 89	34 74	27 99	0 037		4726 8
0300	-01 97	34 78	28 02	0 042		4728 7
0300	-01 97	34 78	28 02		*6 60	4728 7
0400	-01 94	34 85	28 08	0 047		4735 4
0500	-01 93	34 91	28 13	0 046		4741 8
0515	-01 90	34 92	28 14		*6 58	4743 2

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00563	0006	11	10	956	01	72	25S	174	10E	0525	05

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	33	24	78	57 8	58 6	70	02	6	2					7	05	22

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 71	34 46	27 76	0 000		4713 6
0000	-01 71	34 46	27 76		*6 51	4713 6
0010	-01 71	34 51	27 80	0 003		4714 4
0010	-01 71	34 51	27 80		*6 45	4714 4
0020	-01 71	34 50	27 79	0 006		4714 9
0025	-01 71	34 50	27 79		*6 37	4715 2
0030	-01 71	34 50	27 79	0 010		4715 5
0050	-01 64	34 51	27 80	0 016		4717 8
0050	-01 64	34 51	27 80		*6 35	4717 8
0075	-01 42	34 52	27 80	0 024		4722 9
0100	-01 13	34 53	27 80	0 031		4728 9
0100	-01 13	34 53	27 80		*6 03	4728 9
0150	-00 08	34 66	27 86	0 045		4748 7
0200	00 81	34 79	27 91	0 057		4765 7
0200	00 81	34 79	27 91		*4 84	4765 7
0250	00 82	34 74	27 87	0 068		4768 6
0300	00 82	34 70	27 84	0 081		4771 4
0300	00 82	34 70	27 84		*4 81	4771 4
0400	00 54	34 72	27 87	0 108		4773 2
0500	-00 03	34 73	27 91	0 130		4770 6
0500	-00 03	34 73	27 91		*5 38	4770 6

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR	HR.	°	′	°	′		
00563	0007	12	27	956	23	77	43S	166	22E	0420	04

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	11	24	01	51 5	53 3	65	01	4	2					8	20	05

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2 ml/l	V_f
0000	-00 96	33 64	27 07	0 000		4721 8
0000	-00 96	33 64	27 07			4721 8
0010	-00 87	34 02	27 37	0 009		4725 4
0010	-00 87	34 02	27 37			4725 4
0020	-00 40	34 29	27 57	0 015		4734 5
0025	-00 30	34 39	27 65			4736 7
0030	-00 49	34 45	27 71	0 019		4734 4
0050	-01 12	34 63	27 88	0 026		4726 5
0050	-01 12	34 63	27 88			4726 5
0075	-01 44	34 70	27 94	0 031		4723 3
0100	-01 71	34 76	28 00	0 034		4720 8
0100	-01 71	34 76	28 00			4720 8
0150	-01 82	34 78	28 02	0 039		4722 1
0200	-01 89	34 80	28 04	0 043		4724 1
0250	-01 94	34 81	28 05	0 047		4726 3
0300	-01 96	34 83	28 06	0 049		4729 0
0300	-01 96	34 83	28 06			4729 0
0400	-01 91	34 86	28 09	0 052		4735 9
0420	-01 89	34 86	28 09			4737 4

SURFACE OBSERVATIONS										
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR	°	′	°	′		
00563	0008	02	07	957	07	66	16S	110	33E	0066	01

WIND		ANEMO HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
00		24	86	00 6	51 7	82	71	6	8					8		

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2 ml/l	V_f
0000	-00 96	33 35	26 84	0 000		4720 5
0000	-00 96	33 35	26 84			4720 5
0010	-01 00	33 36	26 85	0 012		4720 5
0010	-01 00	33 36	26 85			4720 5
0020	-01 10	33 37	26 86	0 024		4719 6
0025	-01 12	33 37	26 86			4719 6
0030	-01 12	33 39	26 87	0 036		4720 0
0050	-00 96	33 52	26 97	0 059		4724 2
0055	-00 87	33 57	27 01			4726 2

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DATE DAY	DATE YR.	DATE HR.	LATITUDE ° '	LONGITUDE ° '	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00563	0009	02	14	957	04	65 25S	109 38E	0495	05

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
09	04	24	83	00 7	52 1	73	02	6	8					8		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 03	33 52	26 98	0 000		4720 2
0000	-01 03	33 52	26 98			4720 2
0010	-01 13	33 58	27 03	0 011		4719 5
0010	-01 13	33 58	27 03			4719 5
0020	-01 16	33 59	27 04	0 021		4719 6
0024	-01 17	33 59	27 04			4719 7
0030	-01 19	33 59	27 04	0 031		4719 8
0048	-01 27	33 59	27 04			4719 6
0050	-01 28	33 62	27 07	0 052		4719 7
0075	-01 44	33 97	27 35	0 073		4720 1
0096	-01 55	34 19	27 53			4720 6
0100	-01 56	34 20	27 54	0 089		4720 7
0150	-01 67	34 26	27 59	0 115		4722 2
0192	-01 75	34 30	27 63			4723 6
0200	-01 76	34 31	27 64	0 139		4724 0
0250	-01 82	34 33	27 66	0 161		4726 1
0287	-01 85	34 34	27 66			4727 9
0475	*-01 06	*33 93	*27 31			*4749 7

SURFACE OBSERVATIONS

CRUISE	STATION	DATE MO.	DATE DAY	DATE YR.	DATE HR.	LATITUDE ° '	LONGITUDE ° '	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00563	0010	02	14	957	19	65 52S	109 26E	0356	03

WIND m/sec	WIND DIR.	ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C DRY	AIR TEMP °C WET	HUMIDITY %	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
06	09	24	84	53 8	55 3	66	01	6	3					8		

SUBSURFACE OBSERVATIONS

SAMPLE DEPTH	T °C	S °/..	σ_t	ΣΔD	O_2ml/l	V_f
0000	-01 44	33 27	26 79	0 000		4712 7
0000	-01 44	33 27	26 79			4712 7
0010	-01 53	33 28	26 80	0 013		4711 9
0010	-01 53	33 28	26 80			4711 9
0020	-01 42	33 35	26 85	0 025		4714 5
0025	-01 39	33 40	26 89			4715 5
0030	-01 40	33 49	26 96	0 037		4716 0
0050	-01 44	33 80	27 22	0 056		4717 9
0050	-01 44	33 80	27 22			4717 9
0075	-01 59	34 04	27 41	0 075		4718 1
0100	-01 71	34 22	27 56	0 090		4718 4
0100	-01 71	34 22	27 56			4718 4
0150	-01 82	34 32	27 65	0 114		4720 1
0200	-01 86	34 40	27 71	0 135		4722 8
0200	-01 86	34 40	27 71			4722 8
0250	-01 84	34 46	27 76	0 153		4726 3
0300	-01 75	34 49	27 78	0 169		4730 9
0350	-01 59	34 50	27 79			4736 4

SURFACE OBSERVATIONS											
CRUISE	STATION	DATE				LATITUDE		LONGITUDE		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YR.	HR.	°	'	°	'		
00563	0011	02	14	957	24	66	12S	109	56E	0304	03

WIND		ANEMO. HGT.	BAR. PRESS.	AIR TEMP °C		HUMIDITY %	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
m/sec	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
03	14	24	85	52 0	54 1	56	01	6	5					8	05	12

SUBSURFACE OBSERVATIONS						
SAMPLE DEPTH	T °C	S ‰	σ_t	ΣΔD	O_2 ml/l	V_t
0000	-01 39	33 32	26 83	0 000		4713 7
0000	-01 39	33 32	26 83			4713 7
0010	-01 41	33 36	26 86	0 012		4714 1
0010	-01 41	33 36	26 86			4714 1
0020	-01 49	33 44	26 93	0 024		4713 8
0025	-01 52	33 49	26 97			4713 8
0030	-01 53	33 59	27 05	0 035		4714 4
0050	-01 56	33 92	27 32	0 052		4716 5
0050	-01 56	33 92	27 32			4716 5
0075	-01 64	34 07	27 44	0 070		4717 4
0100	-01 71	34 20	27 55	0 085		4718 4
0100	-01 71	34 20	27 55			4718 4
0150	-01 72	34 24	27 58	0 111		4721 3
0200	-01 74	34 27	27 60	0 136		4724 1
0250	-01 75	34 31	27 64	0 159		4727 1
0300	-01 76	34 64	27 66	0 181		4730 1
0300	-01 76	34 34	27 66			4730 1

APPENDIX B

SEDIMENT ANALYSIS SUMMARY SHEETS

Explanation of Data

1. Sample Number - a consecutive number, commencing with 1, applied to each bottom grab sample or core taken successively throughout the cruise.

2. Latitude - expressed in degrees, minutes, and seconds.

3. Longitude - expressed in degrees, minutes, and seconds.

4. Date - day (GMT), month, and year.

5. Sampler Type - identified by name of device employed.

6. Water Depth (fm.) - the uncorrected sonic sounding recorded to the nearest whole fathom.

7. Core Length (in.) - recorded to the nearest whole inch as observed in the laboratory. This information is not given when a grab sampler is employed.

8. Core Penetration (in.) - recorded to the nearest whole inch as observed in the field. This information is not given when a grab sampler is employed.

9. Subsample Depth in Core (in.) - depth to the nearest whole inch of the mean depth of the subsample. This information was not entered when a surface grab sample or a short core sample was obtained. The analysis of the subsample is assumed as representative of the entire core length.

10. Color - based on the Geological Society of America Rock-Color chart.

11. Sphericity (avg.) - a measure of the approach of the grain to the form of a sphere and expressed as one of the following: high, medium high, medium, medium low, or low.

12. Roundness (avg.) - a function of the sharpness of the grain edges and recorded as one of the following: very angular, angular, subangular, subrounded, rounded, or well rounded.

13. Surface Texture (avg.) - a description of the physical appearance of the grain surface recorded as dull or polished and one of the following: smooth, striated, faceted, frosted, pitted, or etched.

14. Total Subsample Dry Weight (gm.) - dry weight to the nearest tenth of a gram.

15. Size Analysis - sample size fraction values are based on dry weight and given in phi(ϕ) units to the nearest whole percent. An American Instrument Company sieving machine and U. S. Standard sieves are used for determining sand and larger size fractions. The pipette method of analysis was used for determining the silt and clay fractions.

QDϕ - (phi quartile deviation) - is that statistical parameter which is a measure of one half of the spread of the quartiles and is expressed in phi units to the nearest tenth with the given value computed from the formula:

$$QD\phi = \frac{Q_{3\phi} - Q_{1\phi}}{2}$$

SKϕ - (phi quartile skewness) - is that statistical parameter which is a measure of half the sum of the first and third quartile values less the median and is expressed in phi units to the nearest hundredth with the given value computed from the formula:

$$SK\phi = \frac{Q_{3\phi} + Q_{1\phi}}{2} - Md\phi$$

MDϕ - (phi median) - is the middlemost member of the distribution curve above which 50 percent of the diameters in the distribution are larger and below which 50 percent of the diameters are smaller and is expressed to the nearest tenth of a phi unit.

The following table is presented for the conversion of phi units to millimeters:

Phi (ϕ)	Millimeters
-2	4.0
-1	2.0
0	1.0
1	0.50
2	0.25
3	0.125
4	0.0625
5	0.0313
6	0.0156
7	0.0078
8	0.0039

16. Wet Density (lbs./ft.^{3}) - density measured to the nearest tenth of a pound as determined by means of a "Mudwate" hydrometer.

17. Water Content (%) - based on dry weight of the sample and measured to the nearest whole percent.

18. Maximum Porosity (%) - the percentage of pore space in the total volume of the uncompacted sample not occupied by solid matter; computed by the formula, $P = 100 \left(V - \frac{v}{V}\right)$, where P is the porosity in percent, V is the bulb volume, and v is the aggregate volume of the grains.

19. Minimum Porosity (%) - the percentage of pore space in the total volume of the compacted sample not occupied by solid matter; computed by the same formula as given in maximum porosity.

20. Odor - a qualitative description of any noticeable odors.

21. Rigidense (mm.) - determined by means of a Rigidense instrument and measured to the nearest millimeter. For a detailed description of this test procedure refer to: Jaffe, G. and Gaetano, F. W., "A Comparison of Atterberg and Rigidense Tests for the Measure of Plasticity", U. S. Navy Hydrographic Office Technical Report No. 11, May 1955."

22. Dominant Mineral (%) - based on microscopic examination of the sand size and larger material recorded in percent.

23. Other Material (%) - based on microscopic analysis.

24. Remarks - supplementary information.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-1 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 70° 32' " S	6. WATER DEPTH (fm.) 1100
3 LONGITUDE 12° 07' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 23 Dec. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Pale Grayish Olive 10 Y 5/2			
11. SPHERICITY (avg.)	High (.7)			
12. ROUNDNESS (avg.)	Low (.2)			
13. SURFACE TEXTURE (avg.)	glassy			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	24.56			
15. SIZE ANALYSIS				
a. < $-2\ \phi$ (%)	QD ϕ	QD ϕ	QD ϕ	QD ϕ
b. $-2\ \phi$ to $-1\ \phi$ (%)	SK ϕ	SK ϕ	SK ϕ	SK ϕ
c. $-1\ \phi$ to $0\ \phi$ (%)	Md ϕ	Md ϕ	Md ϕ	Md ϕ
d. $0\ \phi$ to $1\ \phi$ (%)	0			
e. $1\ \phi$ to $2\ \phi$ (%)	1			
f. $2\ \phi$ to $3\ \phi$ (%)				
g. $3\ \phi$ to $4\ \phi$ (%)	1			
h. $4\ \phi$ to $6\ \phi$ (%)	36			
i. $6\ \phi$ to $8\ \phi$ (%)				
j. > $8\ \phi$ (%)	62			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Qtz. - 40%			
23. OTHER MATERIAL (%)	Feldspar-30%			
	Radiolaria-25%			
	Hornblende-5%			

24. REMARKS:
Pebbles of basic igneous and metamorphic Igneous including gneiss; some with high % of magnetite. Medium to coarse sand fraction contains abundant silicious sponge spicules and Radiolarian tests.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-2 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 71° 18' " S	6. WATER DEPTH (fm.) 120
3. LONGITUDE 13° 32' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 27 Dec. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Grayish Olive 10Y 4/2			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Low (.2)			
13. SURFACE TEXTURE (avg.)	glassy			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	21.43			
15. SIZE ANALYSIS -3.5ϕ to -2.7ϕ	13			
a. -2.7ϕ to -2ϕ	3 QD ϕ 1.76	QD ϕ	QD ϕ	QD ϕ
b. $-2\ \phi$ to $-1\ \phi$ (%)	7 SK ϕ +.49	SK ϕ	SK ϕ	SK ϕ
c. $-1\ \phi$ to $0\ \phi$ (%)	7 Md ϕ 2.50	Md ϕ	Md ϕ	Md ϕ
d. $0\ \phi$ to $1\ \phi$ (%)	8			
e. $1\ \phi$ to $2\ \phi$ (%)	7			
f. $2\ \phi$ to $3\ \phi$ (%)	10			
g. $3\ \phi$ to $4\ \phi$ (%)	13			
h. $4\ \phi$ to $6\ \phi$ (%)	15			
i. $6\ \phi$ to $8\ \phi$ (%)	5			
j. > $8\ \phi$ (%)	12			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	H_2S (foul)			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar - 25%			
23. OTHER MATERIAL (%)	Rock frag. - 40%			
	Quartz - 15%			
	Radiolaria, Sponge } 10%			
	Hornblende 10%			

24. REMARKS:
Abundant rock fragments to cobble size. Biological remains abundant, dominantly silicious sponge spicules and foraminifera.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-3 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 72° 00' " S	6. WATER DEPTH (fm.) 500
3. LONGITUDE 15° 14' " W	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 28 Dec. 1956	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Dark Greenish Gray 5GY 4/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	glassy			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	35.29			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ .85	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	2 SK φ .25	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	3 Md φ 2.15	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	8			
e. 1 φ to 2 φ (%)	31			
f. 2 φ to 3 φ (%)	27			
g. 3 φ to 4 φ (%)	15			
h. 4 φ to 6 φ (%)	9			
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	4			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar - 30%			
23. OTHER MATERIAL (%)	Rock frag. - 50%			
	Quartz - 5%			
	Sponge Spicules - 10%			

24. REMARKS: other - 5%

No radiation over large angular cobble (@ 50 mm.) of probable quartz vein eaten into Basalt country rock. Basalt displays magnetism.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-10 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 75° 07' " S	6. WATER DEPTH (fm.) 180
3. LONGITUDE 25° 55' " W	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 13 Feb. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Light Olive Gray 5Y 5/2			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	glassy to frosted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	34.38			
15. SIZE ANALYSIS −3.5φ to −2.7φ	20			
a. −2.7φ to −2φ	13 QD φ 2.65	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	7 SK φ 1.05	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	7 Md φ .95	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	8			
e. 1 φ to 2 φ (%)	11			
f. 2 φ to 3 φ (%)	14			
g. 3 φ to 4 φ (%)	8			
h. 4 φ to 6 φ (%)	7			
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	5			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar - 55%			
23. OTHER MATERIAL (%)	Quartz - 15%			
	Vol. glass - 5%			
	Hornblende - 5%			

24. REMARKS: Magnetite - 5% Garnet - 5% Mica - 5% Biological specimens removed. Rock fragments in order of abundance - granite type, vein quartz, quartzite, Basalt and basic rocks.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-5 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77 ° 08 ' " S	6. WATER DEPTH (fm.) 154
3. LONGITUDE 45 ° 10 ' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 12 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Very high (.9)			
12. ROUNDNESS (avg.)	Very high (.9)			
13. SURFACE TEXTURE (avg.)	Polished			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	29.95			
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	QD ϕ .035	QD ϕ	QD ϕ	QD ϕ
b. -2 ϕ to -1 ϕ (%)	SK ϕ -.01	SK ϕ	SK ϕ	SK ϕ
c. -1 ϕ to 0 ϕ (%)	1 Md ϕ 1.65	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	4			
e. 1 ϕ to 2 ϕ (%)	85			
f. 2 ϕ to 3 ϕ (%)	10			
g. 3 ϕ to 4 ϕ (%)	1			
h. 4 ϕ to 6 ϕ (%)				
i. 6 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	46			
19. MINIMUM POROSITY (%)	38			
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Quartz-65%			
23. OTHER MATERIAL (%)	Feldspar-25%			
	Garnet-5%			
	other-5%			

24. REMARKS: No radiation over background
Some black organic streaks present
at time of analysis.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER PC-1 STATEN ISLAND	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 77 ° 08 ' " S	6. WATER DEPTH (fm.) 154
3. LONGITUDE 45 ° 10 ' " W	7. CORE LENGTH (in.) 5
4. DATE (Day, month, year) 12 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-1½"	3½"-5"		
10. COLOR	Olive Gray 5Y4/1	Olive Gray 5Y4/1		
11. SPHERICITY (avg.)	Very high (.9)	Very high (.9)		
12. ROUNDNESS (avg.)	Very high (.9)	Very high (.9)		
13. SURFACE TEXTURE (avg.)	frosted	frosted		
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	31.95	34.60		
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	QD ϕ .10	QD ϕ .175	QD ϕ	QD ϕ
b. -2 ϕ to -1 ϕ (%)	SK ϕ -.05	SK ϕ -.09	SK ϕ	SK ϕ
c. -1 ϕ to 0 ϕ (%)	Md ϕ 1.30	2 Md ϕ 1.67	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	8	9		
e. 1 ϕ to 2 ϕ (%)	87	78		
f. 2 ϕ to 3 ϕ (%)	4	9		
g. 3 ϕ to 4 ϕ (%)	1	1		
h. 4 ϕ to 6 ϕ (%)	1	1		
i. 6 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	43	34		
19. MINIMUM POROSITY (%)	36	31		
20. ODOR	slightly earthy			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Quartz-65%	Quartz-65%		
23. OTHER MATERIAL (%)	Feldspar-25%	Feldspar-25%		
	Garnet-5%	Garnet-5%		
	other-5%	other-5%		

24. REMARKS: Considerable loss of water has occurred
from this core at time of analysis.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-6 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77 ° 16 ' " S	6. WATER DEPTH (fm.) 160
3. LONGITUDE 48 ° 12 ' " W	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 14 Jan. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Light Olive Gray 5Y 5/2			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	Med. (.5)			
13. SURFACE TEXTURE (avg.)	glassy to frosted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	26.63			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	QD ϕ .14	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	SK ϕ .07	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	Md ϕ 1.97	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	1			
e. 1 ϕ to 2 ϕ (%)	57			
f. 2 ϕ to 3 ϕ (%)	35			
g. 3 ϕ to 4 ϕ (%)	2			
h. 4 ϕ to 6 ϕ (%)	3			
i. 6 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)	2			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar - 60%			
23. OTHER MATERIAL (%)	Quartz - 30%			
	Garnet - 5%			
	other - 5%			

24. REMARKS: No radiation over background.
Dark organic material present at time of analysis but no resistant organic remains.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-9 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77 ° 21 ' " S	6. WATER DEPTH (fm.) 164
3. LONGITUDE 44 ° 30 ' " W	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 20 Jan. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Medium Olive Gray 5Y 5/1			
11. SPHERICITY (avg.)	High (.9)			
12. ROUNDNESS (avg.)	High (.9)			
13. SURFACE TEXTURE (avg.)	frosted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	27.65			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	QD ϕ .17	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	SK ϕ -.06	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	2 Md ϕ 1.40	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	16			
e. 1 ϕ to 2 ϕ (%)	77			
f. 2 ϕ to 3 ϕ (%)	4			
g. 3 ϕ to 4 ϕ (%)				
h. 4 ϕ to 6 ϕ (%)				
i. 6 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	41			
19. MINIMUM POROSITY (%)	33			
20. ODOR	foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Quartz - 95%			
23. OTHER MATERIAL (%)	grains - 5%			

24. REMARKS: No radiation above background
Sample uniform throughout. Unusually high sorting, sphericity and roundness.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-7 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 75 ° 35 ' " S	6. WATER DEPTH (fm.) 345
3. LONGITUDE 57 ° 48 ' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 16 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	glassy to frosted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	30.64			
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	QD ϕ .35	QD ϕ	QD ϕ	QD ϕ
b. -2 ϕ to -1 ϕ (%)	SK ϕ .17	SK ϕ	SK ϕ	SK ϕ
c. -1 ϕ to 0 ϕ (%)	1 Md ϕ 2.48	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	1			
e. 1 ϕ to 2 ϕ (%)	6			
f. 2 ϕ to 3 ϕ (%)	56			
g. 3 ϕ to 4 ϕ (%)	11			
h. 4 ϕ to 6 ϕ (%)	11			
i. 5 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)	13			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-70%			
23. OTHER MATERIAL (%)	Quartz-30%			

24. REMARKS: No radiation over background.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER PC-2 STATEN ISLAND	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 75 ° 35 ' " S	6. WATER DEPTH (fm.) 345
3. LONGITUDE 57 ° 48 ' " W	7. CORE LENGTH (in.) 12 ½
4. DATE (Day, month, year) 16 Jan. 1957	8. CORE PENETRATION (in.) 40

9. SUBSAMPLE DEPTH IN CORE (in.)	0" - 1½"	5½" - 7"	10½" - 12½"	Cutter
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. High (.7)	Med. Low (.5)	Med. High (.7)	Med. High (.7)
12. ROUNDNESS (avg.)	Med. (.5)	Med. (.5)	Med. Low (.3)	Low (.2)
13. SURFACE TEXTURE (avg.)	glassy	glassy to frosted	frosted	frosted
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	26.14	24.18	31.08	31.78
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	QD ϕ	QD ϕ	QD ϕ	QD ϕ
b. -2 ϕ to -1 ϕ (%)	1 SK ϕ	4 SK ϕ	5 SK ϕ	4 SK ϕ
c. -1 ϕ to 0 ϕ (%)	1 Md ϕ	1 Md ϕ	1 Md ϕ	2 Md ϕ
d. 0 ϕ to 1 ϕ (%)	2	2	2	3
e. 1 ϕ to 2 ϕ (%)	7	4	5	19
f. 2 ϕ to 3 ϕ (%)	26	11	11	4
g. 3 ϕ to 4 ϕ (%)	11	9	10	1
h. 4 ϕ to 6 ϕ (%)	23	31	30	29
i. 5 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)	30	38	36	38
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-70%	Feldspar-65%	Feldspar-60%	Feldspar-60%
23. OTHER MATERIAL (%)	Quartz-30%	Quartz-15%	Quartz-20%	Quartz-10%
		Rock frag.-15%	Rock frag.-15%	Rock frag.-25%
		other-5%	other-5%	other-5%

24. REMARKS: There has been a considerable loss of water from this core at time of analysis. Also there appears to be an abrupt color change at 5½". At 7½" there is group of small medium dark gray sandstone pebbles (1-½"). At 10" there are 3 small pebbles (sandstone, black limestone and chert).

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER OP-8 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 76° 02' " S	6. WATER DEPTH (fm.) 325
3. LONGITUDE 56° 30' " W	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 16 Jan. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Medium Olive Gray 5Y 5/1			
11. SPHERICITY (avg.)	Med. high (.8)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	glassy			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	27.65			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	2 SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	2			
e. 1 φ to 2 φ (%)	3			
f. 2 φ to 3 φ (%)	17			
g. 3 φ to 4 φ (%)	19			
h. 4 φ to 6 φ (%)	24			
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	31			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	NONE			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-55%			
23. OTHER MATERIAL (%)	Quartz-30% Vol. glass-5% Hornblende, garnet 5% mica Tr			

24. REMARKS: No radiation over background. Bag contains pebbles and granules (equiangular) of quarzite and large pebbles of dark, quartzitic, fine grained igneous rocks.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER PC-3 STATEN ISLAND	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 76° 02' " S	6. WATER DEPTH (fm.) 325
3. LONGITUDE 56° 30' " W	7. CORE LENGTH (in.) 7
4. DATE (Day, month, year) 17 Jan. 1957	8. CORE PENETRATION (in.) 16

9. SUBSAMPLE DEPTH IN CORE (in.)	0" - 1½"	5½" - 7"	Cutter	
10. COLOR	Medium Olive Gray 5Y 5/1			
11. SPHERICITY (avg.)	Low (.4)	Med. low (.5)	Low (.4)	
12. ROUNDNESS (avg.)	Low (.2)	Low (.2)	Low (.2)	
13. SURFACE TEXTURE (avg.)	frosted to glassy	glassy	glassy	
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	52.11	47.65	42.56	
15. SIZE ANALYSIS −3.5φ to −2.7φ	6			
a. −2.7φ to −2φ	1 QD φ1.33	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	3 SK φ+.58	3 SK φ	4 SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ3.10	2 Md φ	2 Md φ	Md φ
d. 0 φ to 1 φ (%)	2	3	2	
e. 1 φ to 2 φ (%)	6	5	5	
f. 2 φ to 3 φ (%)	26	8	8	
g. 3 φ to 4 φ (%)	25	8	8	
h. 4 φ to 6 φ (%)	6	31	31	
i. 6 φ to 8 φ (%)	9			
j. > 8 φ (%)	15	40	40	
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-55%	Feldspar-60%	Feldspar-40%	
23. OTHER MATERIAL (%)	Quartz-30% Vol. glass-5% Hornblende, Garnet 5% Mica - Tr	Quartz-30% Vol. glass-5% other-5%	Quartz-25% Rock frag.-15% Vol. glass-10% Hornblende, Garnet 10%	

24. REMARKS: Core becomes finer toward bottom with a slight change in color.

WEDDELL SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER OP-4 STATEN ISLAND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77 ° 37 ' " S	6. WATER DEPTH (fm.) 235
3. LONGITUDE 43 ° 15 ' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 11 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Quartered			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	frosted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	39.98			
15. SIZE ANALYSIS: < -2.7φ	13			
a. -2.7φ to -2φ	6 QD φ 2.54	QD φ	QD φ	QD φ
b. -2 φ to -1 φ (%)	7 SK φ -.69	SK φ	SK φ	SK φ
c. -1 φ to 0 φ (%)	4 Md φ 2.05	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	6			
e. 1 φ to 2 φ (%)	13			
f. 2 φ to 3 φ (%)	17			
g. 3 φ to 4 φ (%)	10			
h. 4 φ to 6 φ (%)	16			
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	9			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Quartz - 35%			
23. OTHER MATERIAL (%)	Rock frag. - 50%			
	Garnet - 10%			
	other - 5%			

24. REMARKS: Some small Basalt pebbles. No radiation over background count. Pelecypods and Bryozoan-attached stones have been removed in field. Many of rock fragments are highly magnetic.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 1 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77° 36' " S	6. WATER DEPTH (fm.) 220
3. LONGITUDE 166° 07' " E	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 28 Oct. 1956	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y 4/1			
11. SPHERICITY (avg.)	Med high (.7)			
12. ROUNDNESS (avg.)	Med. low (.4)			
13. SURFACE TEXTURE (avg.)	dull, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	17.48			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ 1.89	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	3 SK φ .27	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ 4.90	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	2			
e. 1 φ to 2 φ (%)	4			
f. 2 φ to 3 φ (%)	10			
g. 3 φ to 4 φ (%)	19			
h. 4 φ to 6 φ (%)	24			
i. 6 φ to 8 φ (%)	15			
j. > 8 φ (%)	22			
16. WET DENSITY (lbs./ft.^{3})				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	very foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. glass - 30%			
23. OTHER MATERIAL (%)	Vol. frag. - 10%			
	Shells } 40%			
	Spicules }			

24. REMARKS: Feldspar - 10%, Quartz - 5%, Magnetite - 5%. Abundance of siliceous sponge spicules, basaltic pebbles (2-5 cm. diam.) and bryozoan remains. 1 volcanic glass pebble (6 cm. long) with phenocrysts of hornblende (1-2 cm.). Also small scoria pebble.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 8 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 77° 43' 06" S	6. WATER DEPTH (fm.) 230
3. LONGITUDE 166° 21' 30" E	7. CORE LENGTH (in.) 2
4. DATE (Day, month, year) 27 Dec. 1956	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y 3/2			
11. SPHERICITY (avg.)	Med high (.7)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	38.00			
15. SIZE ANALYSIS				
a. < −2 φ (%)	20 QD φ 1.06	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	24 SK φ +.01	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	24 Md φ −.72	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	15			
e. 1 φ to 2 φ (%)	5			
f. 2 φ to 3 φ (%)	4			
g. 3 φ to 4 φ (%)	6			
h. 4 φ to 6 φ (%) }				
i. 6 φ to 8 φ (%) }	3			
j. > 8 φ (%) }				
16. WET DENSITY (lbs./ft.^{3})				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	44			
19. MINIMUM POROSITY (%)	33			
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag. - 65%			
23. OTHER MATERIAL (%)	Vol. glass - 10%			
	Spicules - 10%			
	Feldspar - 10%			

24. REMARKS: other - 5%

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 9 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77° 43' 06" S	6. WATER DEPTH (fm.) 230
3. LONGITUDE 166° 21' 30" E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 27 Dec. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. low (.5)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	dull, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	—			
15. SIZE ANALYSIS	No size analysis			
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)				
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%)				
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. glass			
23. OTHER MATERIAL (%)	feldspar			

24. REMARKS: Two fine-grained, pebble sized volcanic rocks (appear to be volcanic bomb fragments). Dark, transparent, wedge shaped phenocrysts identified tentatively as plagioclase feldspar. Some limonite weathering on surface.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 10 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 77° 46' 06" S	6. WATER DEPTH (fm.) 280
3. LONGITUDE 166° 26' " E	7. CORE LENGTH (in.) 2
4. DATE (Day, month, year) 29 Dec. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	16.05			
15. SIZE ANALYSIS				
a. < −2 φ (%)	39 QD φ 1.12	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	24 SK φ 0.18	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	16 Md φ -1.57	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	10			
e. 1 φ to 2 φ (%)	4			
f. 2 φ to 3 φ (%)	3			
g. 3 φ to 4 φ (%)	3			
h. 4 φ to 6 φ (%) }				
i. 6 φ to 8 φ (%) }	1			
j. > 8 φ (%) }				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	46			
19. MINIMUM POROSITY (%)	37			
20. ODOR	none			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag. -90%			
23. OTHER MATERIAL (%)	Feldspar-5%			
	Spicules-5%			
	Shells - R			

24. REMARKS: Fine to coarse sand; siliceous sponge spicules and spines at top of core.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 12 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 77° 46' 18" S	6. WATER DEPTH (fm.) 279
3. LONGITUDE 166° 26' " E	7. CORE LENGTH (in.) 3
4. DATE (Day, month, year) 8 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y4/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	polished, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	24.24			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	QD ϕ	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	10 SK ϕ	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	8 Md ϕ	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	16			
e. 1 ϕ to 2 ϕ (%)	15			
f. 2 ϕ to 3 ϕ (%)	12			
g. 3 ϕ to 4 ϕ (%)	17			
h. 4 ϕ to 6 ϕ (%) }	15			
i. 6 ϕ to 8 ϕ (%) }				
j. > 8 ϕ (%)	6			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	none			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. glass-45%			
23. OTHER MATERIAL (%)	Vol. frag.-30%			
	Spicules-5%			
	Feldspar-15%			
24. REMARKS:	Quartz-5%			

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 13 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 77° 46' 18" S	6. WATER DEPTH (fm.) 279
3. LONGITUDE 166° 26' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 8 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Black 5Y2/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	34.66			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	37 QD ϕ 1.89	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	17 SK ϕ .84	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	10 Md ϕ -1.36	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	8			
e. 1 ϕ to 2 ϕ (%)	7			
f. 2 ϕ to 3 ϕ (%)	5			
g. 3 ϕ to 4 ϕ (%)	7			
h. 4 ϕ to 6 ϕ (%) }	4			
i. 6 ϕ to 8 ϕ (%) }				
j. > 8 ϕ (%)	6			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	none			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag.-55%			
23. OTHER MATERIAL (%)	Vol. glass-25%			
	Spicules-5%			
	Feldspar-10%			
24. REMARKS:	Quartz-5%			

Pebble (5X4X3 cm.) of decomposed porphyritic rock. Coral, siliceous sponge spicules and worm tubes present. Many small pebbles composed probably of hornblende and feldspars.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-2 ATKA	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 77 ° 33 ' 18 " S	6. WATER DEPTH (fm.) 153
3. LONGITUDE 166 ° 10 ' " E	7. CORE LENGTH (in.) 12 ½
4. DATE (Day, month, year) 21 Dec. 1956	8. CORE PENETRATION (in.) 13 ⅝

9. SUBSAMPLE DEPTH IN CORE (in.)	0" – 3"	9" – 12"		
10. COLOR	Grayish Black N 2	Olive Black 5Y 2/1		
11. SPHERICITY (avg.)	Med. low (.5)	Med. high (.7)		
12. ROUNDNESS (avg.)	Low (.3)	Low (.3)		
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough		
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	43.10	77.90		
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ 1.15	32 QD φ 1.62	QD φ	QD φ
b. −2 φ to −1 φ (%)	6 SK φ 0.00	18 SK φ 0.11	SK φ	SK φ
c. −1 φ to 0 φ (%)	11 Md φ 1.45	15 Md φ 1.00	Md φ	Md φ
d. 0 φ to 1 φ (%)	23	13		
e. 1 φ to 2 φ (%)	24	9		
f. 2 φ to 3 φ (%)	16	6		
g. 3 φ to 4 φ (%)	13	3		
h. 4 φ to 6 φ (%)	6	3		
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	52	43		
19. MINIMUM POROSITY (%)	39	32		
20. ODOR	—			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	* Vol. frag. – 55%	* Vol. frag. – 65%		
23. OTHER MATERIAL (%)	Shells, spicules 15%; Vol. glass – 10%; Feldspar – 10%	Vol. glass – 20%; Feldspar – 10%; Spicules – 5%		

24. REMARKS:
* Feldspar crystals in fragments. Shell fragments, worm tubes and silicious sponge spicules are abundant. Finely stratified layers from mm. to cm thick occur. Corer was equipped with piston.

MC MURDO SOUND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-4 ATKA	5. SAMPLER TYPE 40 lb. Phleger Core
2. LATITUDE 77 ° 48 ' 50 " S	6. WATER DEPTH (fm.) 282
3. LONGITUDE 166 ° 31 ' 30 " E	7. CORE LENGTH (in.) 1
4. DATE (Day, month, year) 22 Feb. 1957	8. CORE PENETRATION (in.) 1 ½

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Grayish Black N 2			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	High (.8)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	—			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)				
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%)				
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	—			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag. – 75%			
23. OTHER MATERIAL (%)	Vol. glass – 10%; Feldspar – 10%; Quartz – 5%; Spicules – Tr			

24. REMARKS:
Insufficient sample for analysis. Black, medium to coarse-grained, volcanic sand with several bryozoan stems.

KAINAN BAY

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-3 ATKA	5. SAMPLER TYPE 80lb. Phleger Core
2. LATITUDE 78° 09' 54" S	6. WATER DEPTH (fm.) 336.5 (wire sound.)
3. LONGITUDE 162° 24' 42" W	7. CORE LENGTH (in.) 41
4. DATE (Day, month, year) 1 Jan. 1957	8. CORE PENETRATION (in.) 53

9. SUBSAMPLE DEPTH IN CORE (in.)	Weight	0"-2"	8"-10"	17"-19"
10. COLOR	Light Olive Gray 5Y 5/2	Olive Gray 5Y/4 1	Olive Gray to Olive Black 5Y 3/1	Olive Gray 5Y4/1
11. SPHERICITY (avg.)	Med. (.6)	Med. Low (.5)	Med. (.6)	Med. low (.5)
12. ROUNDNESS (avg.)	Med. low (.4)	Med. low (.4)	Med. (.6)	Med. (.6)
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough	dull, rough	dull, rough
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	22.42	23.03	24.44	22.16
15. SIZE ANALYSIS				
a. < -2 φ (%)	QD φ	12 QD φ	QD φ	QD φ
b. -2 φ to -1 φ (%)	1 SK φ	2 SK φ	7 SK φ	7 SK φ
c. -1 φ to 0 φ (%)	1 Md φ	2 Md φ	4 Md φ	2 Md φ
d. 0 φ to 1 φ (%)	1	2	5	2
e. 1 φ to 2 φ (%)	1	2	6	5
f. 2 φ to 3 φ (%)	1	4	7	9
g. 3 φ to 4 φ (%)	3	5	7	9
h. 4 φ to 6 φ (%)	22	29	30	23
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	69	42	34	42
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None	None	None	None
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-60%	Feldspar-60%	Feldspar-60%	Feldspar-65%
23. OTHER MATERIAL (%)	Quartz-35%	Quartz-25%	Quartz-25%	Quartz-25%
	Org. matter-R	Rock frag.*-10%	Rock frag.**-10%	Rock frag.***-5%
	Mica - 5%	Mica - 5%	Mica - 5%	Mica - 5%

24. REMARKS: Corer equipped with piston. Gas formed throughout core. Some small rock fragments scattered throughout core.
* Quartz pebbles ** Dark, fractured, metamorphic rock pebbles
*** Granitic pebbles

KAINAN BAY

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-3 ATKA (CONT.)	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 78° 09' 54" S	6. WATER DEPTH (fm.) 336.5 (wire sound.)
3. LONGITUDE 162° 24' 42" W	7. CORE LENGTH (in.) 41
4. DATE (Day, month, year) 1 Jan. 1957	8. CORE PENETRATION (in.) 53

9. SUBSAMPLE DEPTH IN CORE (in.)	25"-27"	33"-35"	39"-41"	Cutter
10. COLOR	Olive Gray 5Y4/1	Olive Gray 5Y4/1	Olive Gray 5Y4/1	Olive Gray 5Y4/1
11. SPHERICITY (avg.)	Med. (.6)	Med. (.6)	Med. (.6)	Med. (.6)
12. ROUNDNESS (avg.)	Med. (.6)	Med. (.6)	Med. (.6)	Med. (.6)
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough	dull, rough	dull, rough
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	34.35	33.79	29.50	22.20
15. SIZE ANALYSIS				
a. < -2 φ (%)	QD φ	6 QD φ	4 QD φ	QD φ
b. -2 φ to -1 φ (%)	11 SK φ	1 SK φ	3 SK φ	6 SK φ
c. -1 φ to 0 φ (%)	3 Md φ	4 Md φ	3 Md φ	3 Md φ
d. 0 φ to 1 φ (%)	4	4	4	4
e. 1 φ to 2 φ (%)	6	6	5	6
f. 2 φ to 3 φ (%)	8	5	7	7
g. 3 φ to 4 φ (%)	8	8	8	8
h. 4 φ to 6 φ (%)	24	26	24	24
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	36	40	41	43
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None	None	None	None
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-60%	Feldspar-60%	Feldspar-65%	Feldspar-60%
23. OTHER MATERIAL (%)	Quartz-25%	Quartz-30%	Quartz-35%	Quartz-30%
	Rock frag.-10%	Rock frag.-10%	Mica - R	Rock frag.-10%
	Mica - 5%	Pyrite - R		Mica - R
		Mica - R		

24. REMARKS: Corer equipped with piston. Gas formed throughout core. Some small rock fragments scattered throughout core.

KAINAN BAY

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 3 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 78° 10' 30" S	6. WATER DEPTH (fm.) 340
3. LONGITUDE 162° 31' " W	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 7 Nov. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Light Olive Gray 5Y 5/2			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	polished, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	18.89			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	1			
e. 1 φ to 2 φ (%)	1			
f. 2 φ to 3 φ (%)	2			
g. 3 φ to 4 φ (%)	2			
h. 4 φ to 6 φ (%)	45			
i. 5 φ to 8 φ (%)				
j. > 8 φ (%)	48			
16. WET DENSITY (lbs./ft.^{3})				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	Vegetable-like			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar - 40%			
23. OTHER MATERIAL (%)	Quartz - 25%			
	Vol. glass - 15%			
	Rock frag. - 10%			
	Spicules - 5%			
	Magnetite - 5%			

24. REMARKS:

This sample appears to be contaminated with volcanics from a previous sampling with the same instrument.

MOUBRAY BAY

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 1 NORTHWIND	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 72 ° 05 ' " S	6. WATER DEPTH (fm.) 205
3. LONGITUDE 171 ° 30 ' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 18 Dec. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Brownish Black 5YR 2/1			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	dull, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	14.80			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	19 QD ϕ .99	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	17 SK ϕ -.10	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	28 Md ϕ -.47	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	24			
e. 1 ϕ to 2 ϕ (%)	10			
f. 2 ϕ to 3 ϕ (%)	2			
g. 3 ϕ to 4 ϕ (%)	R			
h. 4 ϕ to 6 ϕ (%)	R			
i. 5 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)	49.5			
19. MINIMUM POROSITY (%)	44.2			
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag. -50%			
23. OTHER MATERIAL (%)	Vol. glass-30% Magnetite-5% Pyroboles-10%			

24. REMARKS: Feldspar, Quartz } 5%

Black volcanic sand with some shells.

MOUBRAY BAY

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 3 NORTHWIND	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 72 ° 12 ' " S	6. WATER DEPTH (fm.) 111
3. LONGITUDE 170 ° 20 ' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 1 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Grayish Brown 5YR 3/2			
11. SPHERICITY (avg.)	Low (.4)			
12. ROUNDNESS (avg.)	Low (.3)			
13. SURFACE TEXTURE (avg.)	dull, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	38.92			
15. SIZE ANALYSIS				
a. < −2 ϕ (%)	QD ϕ 2.49	QD ϕ	QD ϕ	QD ϕ
b. −2 ϕ to −1 ϕ (%)	24 SK ϕ -1.05	SK ϕ	SK ϕ	SK ϕ
c. −1 ϕ to 0 ϕ (%)	3 Md ϕ 2.79	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	2			
e. 1 ϕ to 2 ϕ (%)	6			
f. 2 ϕ to 3 ϕ (%)	21			
g. 3 ϕ to 4 ϕ (%)	17			
h. 4 ϕ to 6 ϕ (%)	15			
i. 6 ϕ to 8 ϕ (%)	6			
j. > 8 ϕ (%)	6			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Vol. frag. - 20%			
23. OTHER MATERIAL (%)	Vol. glass-5% Shells - 30% Magnetite-20%			

24. REMARKS: Foraminifera-5%
Spicules-5%
Feldspar, Quartz } 10%
Pyroboles-5%

Rock fragments - arkosic sandstone and quartz diorite.

Radiac readings { background .015, sample .03 }

WESTERN ROSS SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 4 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 76° 18' " S	6. WATER DEPTH (fm.) 316
3. LONGITUDE 174° 56' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 8 Nov. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Grayish olive 10Y4/2			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	polished, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	20.33			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	2 SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)	1			
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%) / i. 5 φ to 8 φ (%)	43			
j. > 8 φ (%)	53			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	vegetable-like			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Radiolaria-30%			
23. OTHER MATERIAL (%)	Feldspar-20% Spicules-20% Quartz-20%			
24. REMARKS:	Shells-5% Vol. glass-5%			

WESTERN ROSS SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 5 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 74° 54' 54" S	6. WATER DEPTH (fm.) 175
3. LONGITUDE 174° 52' 54" E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 9 Nov. 1956	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Grayish olive 10Y4/2			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	polished, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	42.04			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ .98	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ .21	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ 2.72	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	5			
e. 1 φ to 2 φ (%)	22			
f. 2 φ to 3 φ (%)	30			
g. 3 φ to 4 φ (%)	20			
h. 4 φ to 6 φ (%) / i. 5 φ to 8 φ (%)	17			
j. > 8 φ (%)	5			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	pungent			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-50%			
23. OTHER MATERIAL (%)	Quartz-30% Rock frag.-10% Spicules-5%			
24. REMARKS:	Magnetite-5%			

Small coral-like bryozoans abundant.

WESTERN ROSS SEA

SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 6 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 73° 46' 36" S	6. WATER DEPTH (fm.) 285
3. LONGITUDE 175° 08' " E	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 9 Nov. 1956	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Grayish Olive 10Y 4/2			
11. SPHERICITY (avg.)	——			
12. ROUNDNESS (avg.)	——			
13. SURFACE TEXTURE (avg.)	——			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	15.63			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	5 SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	1			
e. 1 φ to 2 φ (%)	2			
f. 2 φ to 3 φ (%)	2			
g. 3 φ to 4 φ (%)	2			
h. 4 φ to 6 φ (%) }	32			
i. 6 φ to 8 φ (%) }				
j. > 8 φ (%)	56			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	Vegetable-like			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Shells }			
23. OTHER MATERIAL (%)	Spicules } 95%			
	Spines }			
	Feldspar - 5%			

24. REMARKS: Abundant coral-like bryozoans; siliceous, glass, sponge spicules; occasional pelecypods.

WESTERN ROSS SEA

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 7 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 72° 25' 06" S	6. WATER DEPTH (fm.) 285
3. LONGITUDE 174° 09' 30" E	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 10 Nov. 1956	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Yellowish Gray 5Y 7/2			
11. SPHERICITY (avg.)	——			
12. ROUNDNESS (avg.)	——			
13. SURFACE TEXTURE (avg.)	——			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	——			
15. SIZE ANALYSIS * No size analysis run				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)				
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%)				
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	pungent			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	barnacle plates }	100%		
23. OTHER MATERIAL (%)	bryozoans }			
	corals }			

24. REMARKS: * Fragments generally 1 cm. or longer in size. Some small gastropods and a few sea urchin spines are also present.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 14 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 66 ° 24 ' 24 " S	6. WATER DEPTH (fm.) 28
3. LONGITUDE 110 ° 27 ' 42 " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 29 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR				
11. SPHERICITY (avg.)				
12. ROUNDNESS (avg.)				
13. SURFACE TEXTURE (avg.)				
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)				
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)				
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%)				
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)				
23. OTHER MATERIAL (%)				

24. REMARKS: 1–12 X 8 X 6 cm. granitic pebble; medium-grained containing feldspar, some quartz, pyroboles. Pebble covered with light green organic encrustations and minute mullusca and bryozoa.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 15 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 66 ° 16 ' " S	6. WATER DEPTH (fm.) 40
3. LONGITUDE 110 ° 34 ' 30 " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 31 Jan. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Dusky Yellow Green 5GY5/2			
11. SPHERICITY (avg.)	—			
12. ROUNDNESS (avg.)	—			
13. SURFACE TEXTURE (avg.)	—			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	11.41			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	1 SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	2 Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	1			
e. 1 φ to 2 φ (%)	4			
f. 2 φ to 3 φ (%)	9			
g. 3 φ to 4 φ (%)	21			
h. 4 φ to 6 φ (%)	28			
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	35			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	Vegetable-like			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Diatoms 95%			
23. OTHER MATERIAL (%)	Spicules Feldspar Quartz 5% Mica Org. matter			

24. REMARKS:
High diatom content, large razor clam fragments, siliceous sponge spicules abundant.

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SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 16 GLACIER	5. SAMPLER TYPE 80 lb Phleger Core
2. LATITUDE 66 ° 16 ' " S	6. WATER DEPTH (fm.) 40
3. LONGITUDE 110 ° 34 ' 30 " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 31 Jan, 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Olive Gray 5Y3/2			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. (.6)			
13. SURFACE TEXTURE (avg.)	polished, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	19.66			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ 1.67	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ .80	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ 3.87	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	2			
e. 1 φ to 2 φ (%)	5			
f. 2 φ to 3 φ (%)	17			
g. 3 φ to 4 φ (%)	32			
h. 4 φ to 6 φ (%)	16			
i. 6 φ to 8 φ (%)	8			
j. > 8 φ (%)	20			
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	earthy			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-60%			
23. OTHER MATERIAL (%)	Quartz-25% Mica-10% Pyroboles-5%			

24. REMARKS: Spicules, Diatoms} R

This core when taken was 23" long. This analysis appears to be only for the bottom. The remainder of the core is missing.

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SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 17 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 66 ° 16 ' " S	6. WATER DEPTH (fm.) 40
3. LONGITUDE 110 ° 34 ' 30 " E	7. CORE LENGTH (in.) 15
4. DATE (Day, month, year) 1 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-2"	3"-4"	9"-10"	13"-15"
10. COLOR	Moderate Olive Brown 5Y 4/4	Moderate Olive Brown 5Y4/4	Moderate Olive Brown 5Y4/4	Olive Gray 5Y4/1
11. SPHERICITY (avg.)	—	—	—	—
12. ROUNDNESS (avg.)	—	—	—	—
13. SURFACE TEXTURE (avg.)	—	—	—	—
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	9.98	13.99	9.99	9.48
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ 2.30	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	4 SK φ .95	SK φ	SK φ
c. −1 φ to 0 φ (%)	1 Md φ	4 Md φ 4.50	2 Md φ	1 Md φ
d. 0 φ to 1 φ (%)	3	2	2	2
e. 1 φ to 2 φ (%)	2	3	3	2
f. 2 φ to 3 φ (%)	7	9	9	9
g. 3 φ to 4 φ (%)	21	22	20	24
h. 4 φ to 6 φ (%)	}40	14	}33	}29
i. 6 φ to 8 φ (%)		20		
j. > 8 φ (%)	27	23	32	32
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul	foul	foul	foul
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Diatoms-65%	Diatoms-55%	Diatoms-50%	Diatoms-40%
23. OTHER MATERIAL (%)	Spicules-30% Feldspar, Mica} 5%	Spicules-40% Feldspar, Mica, Pyroboles} 5%	Spicules-40% Feldspar, Mica, Pyroboles} 10%	Spicules-40% Feldspar, Mica, Pyroboles} 20%

24. REMARKS:

Slight banding due to concentrations of organic matter, Shelly layer at 3"-4" from core top. Slight, very fine sand content throughout core.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 18 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 66 ° 16 ' " S	6. WATER DEPTH (fm.) 40
3. LONGITUDE 110 ° 34 ' 30 " E	7. CORE LENGTH (in.) 23
4. DATE (Day, month, year) 1 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-4"	5"-8"	13"-16"	20"-23"
10. COLOR	Moderate Olive Brown 5Y4/4	Moderate Olive Brown 5Y4/4	Olive Gray 5Y4/1	Olive Gray 5Y4/1
11. SPHERICITY (avg.)	—	—	—	Med. (.6)
12. ROUNDNESS (avg.)	—	—	—	Med. low (.4)
13. SURFACE TEXTURE (avg.)	—	—	—	dull, rough
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	10.15	9.61	10.15	22.63
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	QD ϕ	QD ϕ	QD ϕ	QD ϕ 1.06
b. -2 ϕ to -1 ϕ (%)	SK ϕ	SK ϕ	SK ϕ	SK ϕ .77
c. -1 ϕ to 0 ϕ (%)	3 Md ϕ	1 Md ϕ	2 Md ϕ	Md ϕ 3.37
d. 0 ϕ to 1 ϕ (%)	3	3	2	
e. 1 ϕ to 2 ϕ (%)	3	3	2	2
f. 2 ϕ to 3 ϕ (%)	7	8	8	19
g. 3 ϕ to 4 ϕ (%)	21	11	17	46
h. 4 ϕ to 6 ϕ (%)	36	47	34	12
i. 6 ϕ to 8 ϕ (%)				6
j. > 8 ϕ (%)	27	26	35	15
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul	foul	foul	foul
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Diatoms } Spicules } 100% Shells }	Diatoms } Spicules } 100%	Diatoms } Spicules } 100%	Feldspar-65% Quartz-30%
23. OTHER MATERIAL (%)		Mica - R		Diatoms-R Mica } Pyroboles } 5%

24. REMARKS: Core slightly banded due to concentrations of organic materials. Foul odor upon opening dissipated after exposure. Bottom 21"-23" contains very fine sand.

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DEEP FREEZE II

1. SAMPLE NUMBER 19 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 66 ° 15 ' 57 " S	6. WATER DEPTH (fm.) 35
3. LONGITUDE 110 ° 32 ' 35 " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 4 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Moderate Olive Brown 5Y4/4			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	High (.8)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	486.40			
15. SIZE ANALYSIS				
a. < -2 ϕ (%)	55 QD ϕ 3.05	QD ϕ	QD ϕ	QD ϕ
b. -2 ϕ to -1 ϕ (%)	6 SK ϕ 1.27	SK ϕ	SK ϕ	SK ϕ
c. -1 ϕ to 0 ϕ (%)	3 Md ϕ 2.57	Md ϕ	Md ϕ	Md ϕ
d. 0 ϕ to 1 ϕ (%)	5			
e. 1 ϕ to 2 ϕ (%)	9			
f. 2 ϕ to 3 ϕ (%)	16			
g. 3 ϕ to 4 ϕ (%)	4			
h. 4 ϕ to 6 ϕ (%)	3			
i. 6 ϕ to 8 ϕ (%)				
j. > 8 ϕ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	foul			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Pebbles of Quartz, Feldspar, Mica,			
23. OTHER MATERIAL (%)	Pyroboles - 100%			

24. REMARKS: Most pebbles are composed of light gray, gneissic granite and quartzite. Diatoms and spicules are present. Large sample used for better size distribution. Cobbles and pebbles of medium gray granite gneiss and fine-grained basaltic rocks. Cobbles are sub-angular and of high sphericity.

SEDIMENT ANALYSIS SUMMARY SHEET
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DEEP FREEZE II

1. SAMPLE NUMBER 21 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 66 ° 15 ' 57 " S	6. WATER DEPTH (fm.) 19
3. LONGITUDE 110 ° 32 ' 35 " E	7. CORE LENGTH (in.) ——
4. DATE (Day, month, year) 5 Feb. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Moderate Olive Brown 5Y4/4			
11. SPHERICITY (avg.)	Med. high (.7)			
12. ROUNDNESS (avg.)	Med. low (.4)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	855.87			
15. SIZE ANALYSIS				
~~a. < -2 φ (%)~~	QD φ 1.13	QD φ	QD φ	QD φ
~~b. -2 φ to -1 φ (%)~~	SK φ 0.95	SK φ	SK φ	SK φ
~~c. -1 φ to 0 φ (%)~~	Md φ 5.65	Md φ	Md φ	Md φ
~~d. 0 φ to 1 φ (%)~~	> -5.85φ 25	-4.60 to -4.50φ 3	-2.00 to -1.00φ 3	
~~e. 1 φ to 2 φ (%)~~	-5.85 to -5.70φ 13	-4.50 to -4.40φ 2	-1.00 to 0 φ 2	
~~f. 2 φ to 3 φ (%)~~	-5.70 to -5.60φ 15	-4.40 to -4.30φ 1	0 to 1.00 φ 2	
~~g. 3 φ to 4 φ (%)~~	-5.60 to -5.05φ 5	-4.30 to -4.00φ 1	1.00 to 2.00φ 3	
~~h. 4 φ to 6 φ (%)~~	-5.05 to -4.90φ 3	-4.00 to -3.47φ 4	2.00 to 3.00φ 2	
~~i. 6 φ to 8 φ (%)~~	-4.90 to -4.80φ 2	-3.47 to -2.67φ 6	3.00 to 4.00φ 1	
~~j. > 8 φ (%)~~	-4.80 to -4.60φ 2	-2.67 to -2.00φ 4	4.00 to 6.00φ 1	
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Granitic	pebbles containing	Feldspar,	
23. OTHER MATERIAL (%)	Quartz,	Mica.		

24. REMARKS: Net-like bryozoans on largest pebbles. Pebbles mostly granite; some fine-grained quartzite. Large sample utilized for better size distribution. Broken sand dollar shells present. Sand composed of physically weathered grains of quartz, feldspar, mica, traces of garnet etc. derived from pebbles. Diatoms and spicules present.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 22 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 66 ° 15 ' 51 " S	6. WATER DEPTH (fm.) 36
3. LONGITUDE 110 ° 33 ' 11 " E	7. CORE LENGTH (in.) 12
4. DATE (Day, month, year) 7 Feb. 1957	8. CORE PENETRATION (in.) ——

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-3"	9"-12"		
10. COLOR	Moderate Olive Brown 5Y4/4	Olive Gray 5Y3/2		
11. SPHERICITY (avg.)	Med. (.6)	Med. (.6)		
12. ROUNDNESS (avg.)	Med. (.6)	Med. (.6)		
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough		
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	23.26	44.62		
15. SIZE ANALYSIS				
a. < -2 φ (%)	QD φ 1.98	QD φ .40	QD φ	QD φ
b. -2 φ to -1 φ (%)	SK φ 1.08	3 SK φ -0.15	SK φ	SK φ
c. -1 φ to 0 φ (%)	2 Md φ 3.60	1 Md φ 2.95	Md φ	Md φ
d. 0 φ to 1 φ (%)	3	2		
e. 1 φ to 2 φ (%)	4	11		
f. 2 φ to 3 φ (%)	24	50		
g. 3 φ to 4 φ (%)	26	20		
h. 4 φ to 6 φ (%)	10	8		
i. 6 φ to 8 φ (%)	13			
j. > 8 φ (%)	18	5		
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Org. matter-95%	Feldspar-65%		
23. OTHER MATERIAL (%)	Quartz, Feldspar 5%	Quartz-30%, Mica-5%, Spicules-R, Magnetite-R		

24. REMARKS: Coarse towards bottom of core. Core may be reversed. Organic matter is siliceous and includes diatoms and spicules.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 24 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 65° 24' 30" S	6. WATER DEPTH (fm.) 272
3. LONGITUDE 109° 38' " E	7. CORE LENGTH (in.) 6
4. DATE (Day, month, year) 14 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-2"		4"-6"					
10. COLOR	Grayish Olive 10Y4/2		Grayish Olive 10Y4/2					
11. SPHERICITY (avg.)	Med. high (.7)		Med. high (.7)					
12. ROUNDNESS (avg.)	Med. (.6)		Med. (.6)					
13. SURFACE TEXTURE (avg.)	dull, rough		dull, rough					
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	39.70		45.65					
15. SIZE ANALYSIS								
a. < -2 φ (%)		QD φ 1.79		QD φ 1.37		QD φ		QD φ
b. -2 φ to -1 φ (%)	21	SK φ -.29	12	SK φ -.08		SK φ		SK φ
c. -1 φ to 0 φ (%)	4	Md φ 2.08	7	Md φ 1.97		Md φ		Md φ
d. 0 φ to 1 φ (%)	9		13					
e. 1 φ to 2 φ (%)	15		19					
f. 2 φ to 3 φ (%)	18		20					
g. 3 φ to 4 φ (%)	13		12					
h. 4 φ to 6 φ (%)	11		9					
i. 6 φ to 8 φ (%)								
j. > 8 φ (%)	8		7					
16. WET DENSITY (lbs./ft.3)								
17. WATER CONTENT (%)								
18. MAXIMUM POROSITY (%)								
19. MINIMUM POROSITY (%)								
20. ODOR	none		none					
21. RIGIDENSE (mm.)								
22. DOMINANT MINERAL (%)	Feldspar - 65%		Feldspar - 45%					
23. OTHER MATERIAL (%)	Quartz - 25% Foraminifera 5% Rock frag. - 10% Magnetite - 5% Mica - R Spicules - R		Quartz - 40% Fragments - 10% Magnetite 5% Shells - R					

24. REMARKS:

Core predominantly coarse with large pebbles throughout.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 25 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 65° 51' 54" S	6. WATER DEPTH (fm.) 195
3. LONGITUDE 109° 25' 30" E	7. CORE LENGTH (in.) 10½
4. DATE (Day, month, year) 14 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-2½"		8"-10½"					
10. COLOR	Dark Yellowish Brown 10YR4/2		Olive Gray 5Y4/1					
11. SPHERICITY (avg.)	Med. (.6)		Med. (.6)					
12. ROUNDNESS (avg.)	Med. (.6)		Med. (.6)					
13. SURFACE TEXTURE (avg.)	dull, rough		dull, rough					
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	62.44		76.78					
15. SIZE ANALYSIS								
a. < -2 φ (%)		QD φ 1.58		QD φ 1.35		QD φ		QD φ
b. -2 φ to -1 φ (%)	7	SK φ +.33	5	SK φ +.08		SK φ		SK φ
c. -1 φ to 0 φ (%)	8	Md φ 2.00	7	Md φ 2.27		Md φ		Md φ
d. 0 φ to 1 φ (%)	16		13					
e. 1 φ to 2 φ (%)	19		20					
f. 2 φ to 3 φ (%)	16		17					
g. 3 φ to 4 φ (%)	10		10					
h. 4 φ to 6 φ (%)	15		10					
i. 6 φ to 8 φ (%)			10					
j. > 8 φ (%)	10		9					
16. WET DENSITY (lbs./ft.3)								
17. WATER CONTENT (%)								
18. MAXIMUM POROSITY (%)								
19. MINIMUM POROSITY (%)								
20. ODOR	none		none					
21. RIGIDENSE (mm.)								
22. DOMINANT MINERAL (%)	Quartz - 60%		Quartz - 60%					
23. OTHER MATERIAL (%)	Feldspar - 40% Shells - R Rock frag. - 20% Magnetite - R		Feldspar - 40% Spicules - R Rock frag. - 20% Magnetite - R					

24. REMARKS:

Core grades from coarse at top to fine at bottom. No stratigraphic break apparent. Some plant material present at top.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 27 GLACIER	5. SAMPLER TYPE Grab (Orange Peel)
2. LATITUDE 66 ° 12 ' 24 " S	6. WATER DEPTH (fm.) 166
3. LONGITUDE 109 ° 56 ' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 14 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Light olive Brown 5Y 5/6			
11. SPHERICITY (avg.)	Med. (.6)			
12. ROUNDNESS (avg.)	Med. low (.4)			
13. SURFACE TEXTURE (avg.)	dull, rough			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	986.47			
15. SIZE ANALYSIS				
~~a. < −2 φ (%)~~	QD φ 4.38	QD φ	QD φ	QD φ
~~b. −2 φ to −1 φ (%)~~	SK φ 2.87	SK φ	SK φ	SK φ
~~c. −1 φ to 0 φ (%)~~	Md φ 4.10	Md φ	Md φ	Md φ
~~d. 0 φ to 1 φ (%)~~	<5.65φ 16	-3.47to-2.67φ 2	3.00to4.00φ 15	
~~e. 1 φ to 2 φ (%)~~	-5.65to-5.60φ 13	-2.67to-2.00φ 1	4.00to8.00φ 7	
~~f. 2 φ to 3 φ (%)~~	-5.60to-5.30φ 7	-2.00to-1.00φ 1	>8.00φ 5	
~~g. 3 φ to 4 φ (%)~~	-5.30to-5.20φ 6	-1.00to0.00φ 1		
~~h. 4 φ to 6 φ (%)~~	-5.20to-4.50φ 5	0.00to1.00φ 2		
~~i. 6 φ to 8 φ (%)~~	-4.50to-4.00φ 4	1.00to2.00φ 3		
~~j. > 8 φ (%)~~	-4.00to-3.47φ 3	2.00to3.00φ 9		
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	vegetable-like			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar-50%			
23. OTHER MATERIAL (%)	Quartz -20%			
	Rock frag- 20%			
	Magnetite-5%			

24. REMARKS: Mica - R

Globigerina abundant, contains complete suite of pebbles Larger pebbles are slightly altered gneissic granite and smaller ones are of mixed quartzite and granite. Two granite cobbles (13x10x6 and 6x5x4 cm) with encrusting bryozoa.

WILKES LAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER 26 GLACIER	5. SAMPLER TYPE 80 lb. Phleger Core
2. LATITUDE 66 ° 12 ' 24 " S	6. WATER DEPTH (fm.) 166
3. LONGITUDE 109 ° 56 ' " E	7. CORE LENGTH (in.) —
4. DATE (Day, month, year) 14 Feb. 1957	8. CORE PENETRATION (in.) —

9. SUBSAMPLE DEPTH IN CORE (in.)	Complete			
10. COLOR	Gray 5			
11. SPHERICITY (avg.)	Med. low (.5)			
12. ROUNDNESS (avg.)	Med. low (.4)			
13. SURFACE TEXTURE (avg.)	dull, pitted			
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	—			
15. SIZE ANALYSIS				
a. < −2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. −2 φ to −1 φ (%)	SK φ	SK φ	SK φ	SK φ
c. −1 φ to 0 φ (%)	Md φ	Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)				
e. 1 φ to 2 φ (%)				
f. 2 φ to 3 φ (%)				
g. 3 φ to 4 φ (%)				
h. 4 φ to 6 φ (%)				
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)				
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)				
22. DOMINANT MINERAL (%)	Feldspar -50%			
23. OTHER MATERIAL (%)	Quartz-20%			
	Rock frag.-20%			
	Mica - 5%			

24. REMARKS: Magnetite-5%
Shells- R

Insufficient sample for analysis. Composed of coarse sand with pebbles of granitoid rocks. Feldspar grains display good clevage in many cases.

NEW ZEALAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-1 ATKA	5. SAMPLER TYPE Pipe Core
* 2. LATITUDE 41° 19' " S	6. WATER DEPTH (fm.) 8
3. LONGITUDE 174° 53' " E	7. CORE LENGTH (in.) 6
4. DATE (Day, month, year) 4 Dec. 1956	8. CORE PENETRATION (in.) 8

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-3"	3"-6"		
10. COLOR	Dark Gray N3	Olive Gray 5Y4/1		
11. SPHERICITY (avg.)	Med. (.6)	Med (.6)		
12. ROUNDNESS (avg.)	Med. (.6)	Med. (.6)		
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough		
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	25.17	26.27		
15. SIZE ANALYSIS				
a. < -2 φ (%)	QD φ	QD φ	QD φ	QD φ
b. -2 φ to -1 φ (%)	1 SK φ	SK φ	SK φ	SK φ
c. -1 φ to 0 φ (%)	1 Md φ	1 Md φ	Md φ	Md φ
d. 0 φ to 1 φ (%)	1			
e. 1 φ to 2 φ (%)	1	1		
f. 2 φ to 3 φ (%)	3	2		
g. 3 φ to 4 φ (%)	10	11		
h. 4 φ to 6 φ (%)	55	52		
i. 6 φ to 8 φ (%)				
j. > 8 φ (%)	29	33		
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	None			
21. RIGIDENSE (mm.)	4.5			
22. DOMINANT MINERAL (%)	Feldspar-60%	Feldspar-40%		
23. OTHER MATERIAL (%)	Quartz-20%	Quartz-20%		
	Org. matter-20%	Org. matter-40%		
	mica - R	mica - R		

24. REMARKS: * Taken at fuel Pier in harbor of Wellington, New Zealand. Core mostly black fairly compact silt; several distinct layers, bottom fairly hard, some worms and a few shells in sample.

NEW ZEALAND

SEDIMENT ANALYSIS SUMMARY SHEET
PRNC-NHO-1560 (Rev. 11-56)

DEEP FREEZE II

1. SAMPLE NUMBER C-5 ATKA	5. SAMPLER TYPE 40 lb. Phleger Core
2. LATITUDE 43° 36' 02" S	6. WATER DEPTH (fm.) 8
3. LONGITUDE 172° 47' 50" E	7. CORE LENGTH (in.) 10
4. DATE (Day, month, year) 3 March 1957	8. CORE PENETRATION (in.) 12

9. SUBSAMPLE DEPTH IN CORE (in.)	0"-2 3/4"	2 3/4"-5"	5"-8"	8"-10"
10. COLOR	Grayish Black N2	Dark Gray N3	Dark Gray N3	Dark Gray N3
11. SPHERICITY (avg.)	Med. low (.5)	Med. low (.5)	Med. low (.5)	Med. low (.5)
12. ROUNDNESS (avg.)	Med. low (.4)	Med. low (.4)	Med. low (.4)	Med. low (.4)
13. SURFACE TEXTURE (avg.)	dull, rough	dull, rough	dull, rough	dull, rough
14. TOTAL SUBSAMPLE DRY WEIGHT (gm.)	27.04	26.57	25.04	13.40
15. SIZE ANALYSIS				
a. < -2 φ (%)	QD φ	QD φ 1.67	QD φ 1.35	QD φ 1.32
b. -2 φ to -1 φ (%)	SK φ	SK φ 1.07	SK φ -.13	SK φ .19
c. -1 φ to 0 φ (%)	Md φ	Md φ 3.96	Md φ 6.58	Md φ 6.30
d. 0 φ to 1 φ (%)		1		1
e. 1 φ to 2 φ (%)		1		1
f. 2 φ to 3 φ (%)	3	6	1	1
g. 3 φ to 4 φ (%)	3	43	9	7
h. 4 φ to 6 φ (%)	68	18	29	33
i. 6 φ to 8 φ (%)		17	41	34
j. > 8 φ (%)	26	15	20	23
16. WET DENSITY (lbs./ft.3)				
17. WATER CONTENT (%)				
18. MAXIMUM POROSITY (%)				
19. MINIMUM POROSITY (%)				
20. ODOR	NoNe			
21. RIGIDENSE (mm.)				
23. OTHER MATERIAL (%)	Feldspar-50%	Feldspar-50%	Feldspar-30%	Feldspar-50%
	Quartz-25%	Quartz-20%	Quartz-25%	Quartz-25%
	Org. matter-10%	Org. matter-10%	Shells-25%	Shells-15%
24. REMARKS:	Shells-15%	Shells-20%	other-5%	other-10%
			Org. matter-15%	

26. REMARKS: Taken from BT winch. Core shows signs of water dilution from 8"-10". Corer was equipped with piston.

APPENDIX C

PHOTOGRAPHS OF ICE CONDITIONS AND OCEANOGRAPHIC OPERATIONS

List of Plates

PLATE I. Weddell Ice Pack, December 1956. USS WYANDOT follows path opened by USS STATEN ISLAND.

PLATE II. Tabular Iceberg, Weddell Sea, December 1956. Note breakup of pack ice against base of iceberg.

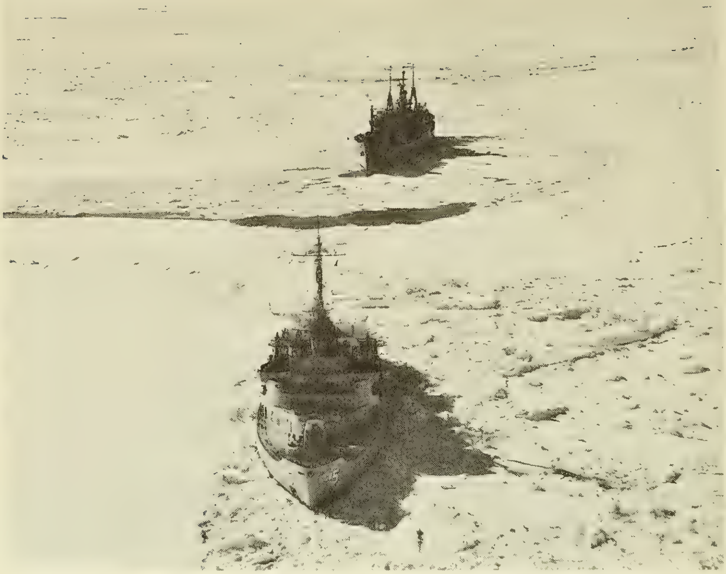

PLATE III. Weddell Ice Pack, December 1956. Note evidence of pressure ridge at left center and wind drift in left foreground.

PLATE IV. Tabular Iceberg, Weddell Sea, December 1956. Note pressure ridges in sea ice.

PLATE V. Weddell Ice Pack, January 1957. Note pressure ridge. Snow cover on ice, effect of wind on snow cover.

PLATE VI. Biological Collection, Weddell Sea. Bottom animals collected by trawl.

PLATE VII. Bottom Fauna, Weddell Sea. Selected specimens taken by trawl in 164 fathoms.

LATE VIII. Ross Ice Pack, October 1956. Ice forced into pressure ridges; note
ard, brittle ice in foreground.

PLATE IX. Ross Ice Pack, December 1956. USS ATKA transits ice pack in convoy with other icebreaker and cargo vessels. Note shape of floes and raised floe edges caused by ice motion during storm periods.

PLATE X. Ice conditions, McMurdo Sound, December 1956. Note ice broken out by icebreakers to provide mooring places for cargo vessels, unbroken bay ice shorefast to Ross Island in background.

PLATE XI. Ice Conditions, McMurdo Sound, February 1957. Note open, broken bay ice, snow-free land area (Marble Point in center of field, Cape Bernacchi in right rear).

PLATE XII. Ice Conditions, McMurdo Sound, February 1957. Note shore lead in background, unbroken bay ice.

PLATE XIII. Ice Conditions, McMurdo Sound, February 1957. Note Dailey Islands in left rear, moraine in left of field, open water with new ice in right of field.

PLATE XIV. Biological Collection, McMurdo Sound. Sorting bottom animals taken by trawl in 58 fathoms.

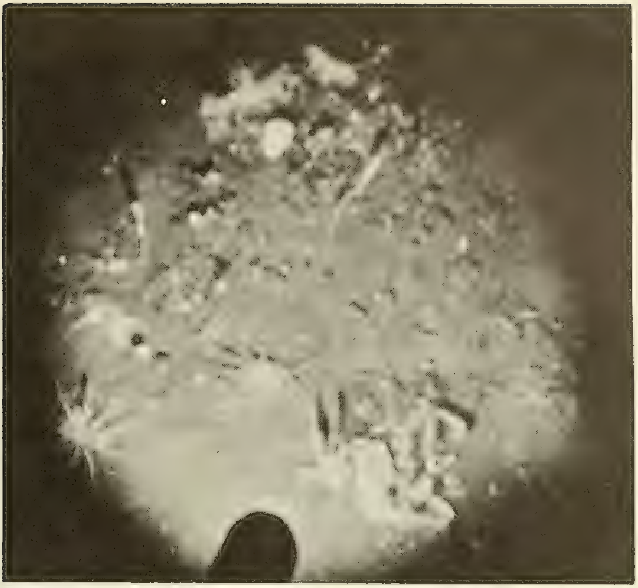

PLATE XV. Bottom Photograph, McMurdo Sound. Note tube worms, crinoids, sponges. Depth, 245 fathoms.

PLATE XVI. Ross Barrier Shelf, Kainan Bay, February 1957. Note typical break-out of shelf ice.

PLATE XVII. Ice Conditions, Moubray Bay, February 1957. Note USS ATKA in ice-f
area, open, broken bay ice in right center, recently calved berg from small ice
shelf in background.

PLATE XVIII. Sample of bottom sediments, Moubray Bay. Orange-peel sampler being emptied of sediments taken at 111 fathoms.

U. S. Navy Hydrographic Office
OPERATION DEEP FREEZE II, 1956-1957. OCEANOGRAPHIC SURVEY RESULTS. October 1957. 156 p., including 29 figs. 19 pl. (TR-29).

Contains the summary and results of oceanographic operation in the Antarctic and adjacent waters. Data on thermal structure, salinity, density, dissolved oxygen content, bottom sediments and biology are presented for the Weddell Sea, Ross Sea, and Vincennes Bay region. Distribution and concentration of sea ice is reported for these areas and for passages into, through, and out of the Antarctic. A discussion of the Antarctic convergence is presented.

Appendix A contains a tabulation of oceanographic data from 50 stations; Appendix B, the analysis of 43 bottom sediment samples; and Appendix C, 18 photographs of ice conditions and oceanographic operations.

1. Antarctic oceanography
2. Antarctic bottom sediments
3. Antarctic ice
4. USS ATKA
5. USS STATEN ISLAND
6. USCGC NORTHWIND
7. USS GLACIER

i. title: Operation DEEP FREEZE II, 1956-1957. Oceanographic Survey Results

ii. TR-29

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Appendix A contains a tabulation of oceanographic data from 50 stations; Appendix B, the analysis of 43 bottom sediment samples; and Appendix C, 18 photographs of ice conditions and oceanographic operations.

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2. Antarctic bottom sediments
3. Antarctic ice
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5. USS STATEN ISLAND
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